18.9.2.2.1

Dalton, Olmsted & Fuglevand, Inc. *Environmental Consultants*

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5/01/03

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MAY 02 2003

Environmental Cleanup Office

May 1, 2003

Peter Contreras, HW-113
U.S. EPA, Region 10
1200 Sixth Avenue
Seattle, WA 98101

Re: Final 2003 Remedial Action Work Plan
Unilateral Administrative Order for Remedial Design and Remedial Action
Head of Hylebos Waterway of the CB/NT Superfund Site
EPA Docket No. CERCLA 10-2002-0065

Dear Peter;

Attached is the Final 2003 Remedial Action Work Plan ("2003 RA Work Plan"). The plan has been revised in accordance with your Conditional Approval dated April 24, 2003, as was discussed during our April 29, 2003 meeting.

Please feel free to contact me with any questions or comments regarding this submittal.

Sincerely

Dalton, Olmsted & Fuglevand, Inc.

Paul Fuglevand, Project Coordinator
For Head of Hylebos Cleanup Group

2003 RA Work Plan Distribution List

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Leslie Ann Rose (1 copy)
Citizens for a Healthy Bay
917 Pacific Avenue, Suite 406,
Tacoma, WA 98402

2003 Remedial Action Work Plan (2003 RA Work Plan)

HEAD OF HYLEBOS WATERWAY PROBLEM AREA
COMMENCEMENT BAY NEARSHORE / TIDEFLATS SUPERFUND SITE
TACOMA, WASHINGTON

Prepared for Head of Hylebos Cleanup Group
ATOFINA Chemicals, Inc.
General Metals of Tacoma, Inc.

Dalton, Olmsted & Fuglevand, Inc. *Environmental Consultants*

Kirkland, Washington
May 1, 2003

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Commencement Bay Nearshore / Tideflats Superfund Site

1 INTRODUCTION & PROJECT BACKGROUND

The 2003 Remedial Action Work Plan ("2003 RA Work Plan") for the Head of Hylebos Waterway is submitted by ATOFINA Chemicals, Inc. ("ATOFINA") and General Metals of Tacoma, Inc. ("General Metals"), collectively referred to in this report as Head of Hylebos Cleanup Group ("HHCG"). The 2003 RA Work Plan is submitted in accordance with Section IV Task 3 of the Statement of Work ("SOW") for the Unilateral Administrative Order for Remedial Design and Remedial Action & Long Term Monitoring for Head of Hylebos Waterway Problem Area of the Commencement Bay Nearshore / Tideflats ("CB/NT") Superfund Site, Tacoma, Washington (Docket No. CERCLA 10-2002-0065) ("UAO").

The 2003 RA Work Plan has been prepared to address all of the remedial and construction actions planned for the 2003 construction window (May 15, 2003 through February 14, 2004) at the Head of Hylebos Waterway under the UAO. The 2003 RA Work Plan includes the following:

- A detailed description of all 2003 remediation and construction activities, including how those activities are to be implemented and coordinated with EPA.
- Identification of discrete elements of the 2003 remedial action for the purpose of monitoring construction activities as they occur.
- Project schedule showing each discrete element and submission of deliverables generated during the remedial action, and describing the interrelationship between various discrete portions of the 2003 remedial and removal actions.
- Submission of the 2003 Construction Quality Assurance Plan (2003 CQAP).
- Submission of the 2003 Sediment Sampling Operations Manual (2003 SSOM).

The 2003 RA Work Plan does not include submission of Contractor Submittals because the contractor will not be retained until after submission of this document. The 2003 RA Work Plan does not include submission of the project OMMP, which will be submitted with the 2004 RA Work Plan.

1.1 PROJECT BACKGROUND

The Head of Hylebos project is located at the eastern end of the Hylebos Waterway, part of the Commencement Bay Nearshore / Tideflats (CB/NT) Superfund site (see Figure 1-1, Vicinity Map). The Head of Hylebos cleanup plan addresses all of the sediment remedial action areas and natural recovery areas identified at the Head of Hylebos Waterway in the U.S. Environmental Protection Agency, Region 10 ("EPA") August 2000 Explanation of Significant Differences ("2000 ESD") (see Figure 1-2) that have not been remediated or included in other EPA or State approved cleanup plans.

The Head of Hylebos project is based on a sequence of activities that starts in 2003 with land-based excavation of the shoreline and marine demolition, followed in 2004 by marine dredging and transition zone grading. The cleanup project is split between the 2003 and 2004 construction seasons as follows:

2003 Activities

Shoreline Work

- Bank Cleanup
- Intertidal Remediation
- Materials Placement
  - Transition Zone Grading Material (TZGM)
  - Quarry Spalls & Boulders & Large Woody Debris at General Metals

Marine Work

- Hylebos Marina Partial Relocation
- ATOFINA Marine Structure Demolition

2004 Activities – Marine Work

- Structure Removal and Replacement
  - Kaiser outfall
  - Weyerhaeuser Log Rafting
- Dredging
- Transition Zone Grading
- Hylebos Marina Dredging and Reconfiguration

Only the 2003 activities are the subject of the 2003 RA Work Plan. The 2004 activities will be addressed in a subsequent remedial action work plan.

1.2 PROJECT ORGANIZATION

The project team consists of the HHCG representatives and the consulting team for remedial design and construction oversight. The qualifications of the construction oversight team are presented below, along with the responsibility, authority, and contact information for key personnel.

1.2.1 HHCG Representatives

The designated representatives of the HHCG members are:

- Fred Wolf, Regional Remediation Manager for ATOFINA Chemicals, Inc.
- Mat Cusma, Environmental Administrator for General Metals of Tacoma, Inc.

Only the HHCG representatives collectively have the authority to enter into or to modify any agreements with EPA or other parties regarding the activities covered by this 2003 RA Work Plan.

1.2.2 Hylebos Marina Representative

The Hylebos Marina will be completing the work described in Section 3.3.1. The designated representative of the Hylebos Marina is Ron Oline, owner. His phone number is 253 272-6623.

1.2.3 Consultant Team

The HHCG will employ the remedial design consultant team for construction oversight to assure continuity between the design and the remedial action. The consultant team for remedial design and construction oversight consists of companies and individuals with extensive experience at Hylebos Waterway, as well as remedial design of other sediment dredging and capping projects. Dalton, Olmsted & Fuglevand, Inc. (DOF) is the prime consultant, supported by DMD, Inc. for analytical laboratory oversight and data validation.

The technical team is organized around the three major components of the project: project management, construction oversight, and sampling and monitoring. Each component is discussed below.

Project Management / Project Coordinator: The project manager is responsible to HHCG for the technical implementation of the work plan, coordination of the technical team, and is the Project Coordinator with EPA for HHCG. Paul Fuglevand (DOF) is the designated project manager / project coordinator for the project. He has been project coordinator for the pre-remedial design (Hylebos Cleanup Committee) since 1993, as well as for remedial design for the Head of Hylebos Waterway under the UAO. He is responsible for the following tasks:

- Project Management
- Project Coordination with EPA
- Work Plan Preparation
- Submission of Progress Reports

Remedial Design & Construction Oversight (CQAO): The remedial design & construction oversight manager is responsible for preparation of the plans and specifications, construction quality plans (CQAP, WQMP, OMMP), and construction oversight. Rob Webb (DOF) is the remedial design & construction oversight manager for the project. Under the 2003 CQAP he has the title of Construction Quality Assurance Official (CQAO). He has been providing design services to the HHCG under the UAO, and has considerable experience in the design and implementation of dredging and capping projects for sediment cleanup. He is responsible for the following tasks:

- Remedial Design
- Construction Quality Assurance Plan
- Water Quality Monitoring Plan
- Operation, Maintenance & Monitoring Plan
- Construction Oversight
- Cost Estimating
- Report Preparation

Sampling and Monitoring: The sampling and monitoring manager will be responsible for overseeing the collection of sediment/water data for design and monitoring, preparation of SAP/QAPP/HSP plans, and preparation of sampling and monitoring data reports. Rob Webb (DOF) will serve as sampling and monitoring manager, with assistance provided by DOF staff and Raleigh Farlow (DMD). Sampling and monitoring tasks are:

- Sampling Plans
- Performance Monitoring
- Long-Term Monitoring
- Sediment Sampling and Analysis
- Data Evaluation
- Report Preparation
- Analytical Laboratory Oversight
- Data Validation and Evaluation
- Report Preparation

1.2.4 Contact Information for Key Personnel

The contact information for key personnel is provided below.

Name Company Responsibility	Address	Phone Numbers V = voice. F = fax M = mobile	email
Fred Wolf ATOFINA HHCG Rep.	Fred Wolf ATOFINA Chemicals 2901 Taylor Way Tacoma, WA 98421-4330	V 253 627-9101 Ext 10 F 253 627-0554 M 253 229-1044	Fredrick.wolf@atofina.com
Mat Cusma	Mat Cusma	V 503 286-6944	mcusma@schn.com

General Metals HHCG Rep.	General Metals of Tacoma P.O. Box 10047 Portland, OR 97201	F 503 286-6948 M 503 209-6057	
Paul Fuglevand DOF Proj. Coordinator	Paul Fuglevand Dalton, Olmsted & Fuglevand, 10827 NE 68th St. Kirkland, WA 98033	V 425 827-4588 F 425 739-9885 M 206 660-3079	pfuglevand@dofnw.com
Rob Webb DOF Remedial Design and Construction Oversight CQAO	Rob Webb Dalton, Olmsted & Fuglevand *10705 Silverdale Way NW* *Suite 201* *Silverdale, WA 98383*	V 360-692-7345 F 360-692-1895 M 360-908-1386	rwebb@dofnw.com
Raleigh Farlow DMD Analytical Laboratory QA	Raleigh Farlow D.M.D. Inc. 13706 SW Caster Road Vashon, WA 98070	V 206 463-6223 F 206 463-4013	dmdinc@telisphere.com

1.3 DISTRIBUTION LIST FOR 2003 RA WORK PLAN

The 2003 RA Work Plan distribution list is as follows:

- Fred Wolf, ATOFINA for HHCG
- Mat Cusma, General Metals for HHCG
- Ron Oline, Hylebos Marina
- Paul Fuglevand, DOF for HHCG
- Rob Webb, DOF for HHCG – CQAO copy to be kept at field office
- Raleigh Farlow for HHCG – Analytical Laboratory QA
- Peter Contreras, EPA
- Paul Johanson, URS for EPA
- Beth Coffey, USACE
- Russ McMillan, Washington Department of Ecology
- Robert Taylor, NOAA Damage and Restoration Center

1.4 ELEMENTS OF THE REPORT

The 2003 RA Work Plan is subdivided into the following sections:

Data Summary (Section 2)

- Summary of pre-remedial design sediment sampling and analysis
- Summary of pre-remedial design water-quality testing

- Summary of dredged material sampling and analysis program

2003 Activities (Section 3)

- 2003/2004 Sequencing Plan
- 2003 Shoreline Work
- 2003 Marine Work
- 2003 Sediment Characterization
- 2003 Natural Recovery Monitoring
- 2003 Contractor Submittals
- 2004 Activities

Substantive Requirements and Permits (Section 4)

- Access Agreements
- Applicable, or Relevant and Appropriate, Requirements -ARARs
- Permit Requirements

Schedule (Section 5)

- Construction Window
- 2003 Schedule of Discrete Elements
- 2003 Schedule of Deliverables

Contingency Actions (Section 6)

- Grading
- ATOFINA Salt Pads

2 DATA SUMMARY

Extensive pre-remedial design sampling was completed within the Head of Hylebos Waterway Problem Area from 1993 through 2000. This section of the 2003 RA Work Plan includes a brief summary of the work completed, identifying key documents, and summarizing key conclusions and sampling results. The locations of the sediment samples from the Head of Hylebos Problem Area are shown on Figures 2-1 through 2-6.

2.1 SEDIMENT CLASSIFICATION

Physical Setting

Prior to development, the Port of Tacoma area was largely a tide flat of the Puyallup River delta. The Hylebos Waterway, like most of the Port of Tacoma waterways, was constructed by dredging a channel into the tide flat, with placement of the dredged material onto the adjacent lands to create uplands, as shown on Figure 2-7. The excavation for the channel extended to as deep as 30 feet below the original grade. The material exposed in the bottom of the channel excavation, having been overlain by up to 30 feet of soil for thousands of years, was compact and relatively dense sediment that was naturally deposited and free of any contamination. Throughout this report, this relatively dense and clean sandy material that underlies the original channel excavation is referred to as **Native** sediment.

Dredging the Hylebos channel resulted in the creation of a relatively deep body of water that forms the waterway. All of the sediment that is found above the original extent of the channel, overlying the Native sediment, has accumulated since the waterway was dredged (1930s through 1960s). Consequently this accumulated sediment is referred to as **Recent** sediment throughout this report, as its deposition has been over recent times. The Recent sediment accumulated on top of the relatively dense, clean, Native sediment.

Along the shoreline, within the intertidal elevations, the Recent sediment is generally composed of a sandy material that has accumulated due to shoreline erosion of the adjacent bank. The Native sediment is often silty material associated with the surface of the historic tide flat.

2.2 SEDIMENT CHEMISTRY AND BIOLOGICAL DATA

The following subsections summarize the sediment chemistry and biological data collected in Hylebos Waterway as originally presented in the Pre-Remedial Design Evaluation Report[1] ("Evaluation Report").

[1] Pre-Remedial Design Evaluation Report. Hylebos Waterway. Commencement Bay Nearshore / Tideflats Superfund Site.

2.2.1 Sediment Chemistry, Surface Samples

A total of 557 surface sediment samples were collected from the Hylebos Waterway and chemically analyzed since 1990. Depending on the information available at the time of the survey and the purpose of the data collection, the list of chemicals analyzed at a station varied from the full ROD list of chemicals of concern to one indicator chemical.

Figure 2-1 shows the chemicals that exceed the CB/NT Sediment Quality Objectives ("SQOs") (Table 1-1) and associated exceedance factors for subtidal and intertidal surface stations at the Head of Hylebos Waterway. The exceedance factor (EF) is the concentration of the chemical in sediment divided by the SQO for surface sediment for that chemical. For example, if a sediment concentration were measured at 200 mg/kg for a chemical that has an SQO of 100 mg/kg, the exceedance factor would be 200/100 = 2. The distribution of PCBs in the Hylebos Waterway relative to the SQO (300 ug/kg) and SRAL (450 ug/kg) is summarized in Figure 2-2.

One of the final testing programs of the pre-remedial design was the collection and testing of over 300 surface sediment samples from Hylebos Waterway to refine the remedial action area boundaries. These boundary refinement stations were tested for specifically defined indicator compounds. The results of the testing were compared to Highest No Effects Concentrations (HNECs) derived from site-specific ecological, chemical, and biological data. The HNEC concentration is the highest concentration in Hylebos sediments that has been demonstrated to result in no adverse biological effects. PCBs results were compared to EPA's revised cleanup level of 300 ug/kg and EPA's sediment remedial action level (SRAL) of 450 ug/kg (EPA's ESD, 1997). The results of the boundary refinement sampling is presented on Figure 2-6.

2.2.2 Sediment Biology

Since 1990, 87 subtidal surface and 27 intertidal surface samples from Hylebos Waterway have been analyzed for sediment toxicity. Sediment characterization involved the 10-day amphipod, larval development, and *Neanthes* growth bioassays. Bioassay response has varied from no response to 100 percent response depending on waterway location. Hylebos Waterway bioassay data are contained in Figure 2-4. In addition, 65 samples from the HCC's Event 1A subsurface sediment investigation were tested for sediment toxicity.

Since 1990, 68 subtidal surface sediment samples have been collected and analyzed for benthic infauna abundance. Most samples are composed of four replicate grab samples. However, in areas inaccessible by boat, divers collected ten 10-cm deep hand cores. Comparisons between reference and test stations always involved data collected by similar field equipment. Of the 68 samples, 9 were found to lack an appropriate reference station.

Therefore, benthic data from only 59 stations have been used to evaluate sediment quality in the waterway. Benthic abundance comparisons have varied from no change to substantial change relative to the reference conditions, depending on waterway location. Benthic abundance data are contained in Figure 2-5.

2.2.3 Pre-Remedial Design Data Evaluation

The results of chemical and biological testing of surface sediments were evaluated for Hylebos Waterway in the Evaluation Report. The results of that evaluation for each data point in the Head of Hylebos Waterway Problem Area are represented graphically on Figure 2-6. Figure 2-6 presents the sediment management areas derived from the data as well as the Wood Debris Group cleanup areas at the upper turning basin of the waterway.

2.3 WATER QUALITY TESTING, PRE-REMEDIAL DESIGN

The objective of the pre-remedial design water quality evaluation program was to assess the mobility of representative chemical compounds from Hylebos Waterway dredged sediment that would be placed in an aquatic, nearshore, or upland confined disposal facility (CDF). For the purposes of the program, the dredged sediment was represented by a composite sample identified as HCS1 (see below). Physical testing and partitioning parameter testing were also completed on sample HCS1 to provide data for dredging and disposal site design. Composite sediment sample HCS1, composed of eight cores, was collected from potential dredge areas at the mouth of Hylebos Waterway. The core locations were chosen to produce a composite sample with above-average chemical concentrations as compared with the potential areas that may be dredged. Sample HCS1 was used in the following chemical mobility tests:

- Standard elutriate test (dredging evaluation)
- Modified elutriate test (dredging and in-water disposal evaluation)
- Leachate tests (disposal site evaluation)
    - -Porewater extraction test
    - -Column leach test (CLT)

The chemicals were chosen for chemical mobility testing based on their prevalence of SQO exceedances, and their range of properties that indicate their mobility and persistence in the environment. The chemical mobility data products generated in this effort were used to assess the potential impacts from both dredging and confined disposal of sediment dredged from Hylebos Waterway. The data products were also used to evaluate the limited number of remedial action alternatives and disposal sites with respect to the water quality criteria of the CWA Section 401. The test results relating to dredging are summarized below.

- Standard Elutriate Test: All of the measured compounds were below the marine acute WQC, indicating that no short-term surface water quality impacts are expected at the dredging site or at the disposal site.

- Modified Elutriate Test: All of the measured compounds were below the marine acute WQC, indicating that no short-term water quality impacts are expected at a CDF associated with hydraulic dredging.

2.4 DREDGED MATERIAL SAMPLING AND ANALYSIS PROGRAM

The Partnership for a Clean Waterway (PCW) completed sampling and testing of dredged material from the Head of Hylebos Waterway in December 2000. The purpose of the dredged material sampling and analysis program was to evaluate the characteristics of the dredged material with relation to possible upland disposal, either as part of an industrial fill at the Kaiser Tacoma Works, or at a regional solid waste landfill.

Sampling of dredged material was completed at two stations at the head of Hylebos Waterway, as summarized below:

-Station 1102 - north side of channel in neck between turning basins
adjacent to General Metals, close to former Tacoma Boat
estimated mudline elevation 25 feet below MLLW

-Station 2105 - center of middle turning basin
estimated mudline elevation 32 feet below MLLW

On December 13, 2000 a clamshell bucket (1 to 1.5 cubic yard) operated from a barge-mounted crane collected dredged material and placed it into steel drop boxes located on a flat-deck barge. The drop boxes were transported to the Kaiser Tacoma Works and offloaded inside an industrial building for observation.

For each station, material collected during dredging was composited, sub-sampled, and delivered to Soil Technology for testing of the following physical properties:

Initial Physical Characteristics
- Moisture content
- Grain Size Distribution, including the minus 200 fraction by hydrometer
- Atterberg limits
- Specific Gravity of solids
- Total volatile solids
- Dredging Elutriate Test

Samples of the dredged material were also collected from the drop boxes on December 15, 18, and 20, 2000 and submitted to Soil Technology for measurement of moisture content. Visual observations were also made of the consistency of the material.

On December 20, 2000, the dredged material was transferred to a lined truck and transported to the LRI Landfill for disposal. The testing for disposal included Paint Filter Liquids Test and TCLP metals analysis.

Table 2-1 presents a summary of the collected data, and shows there were no exceedances of TCLP criteria for landfill disposal, and no exceedance of paint filter test criteria (including the day of dredging) for landfill disposal. The results of the dredging elutriate test on the material are presented on Table 2-2 and show there were no exceedances of the applicable marine water quality criteria.

3 2003 ACTIVITIES

This section of the 2003 RA Work Plan provides a detailed description of the 2003 remediation and construction activities at the Head of Hylebos Waterway. The plans and specifications for the 2003 work are presented in Appendix A (submitted under separate cover). The monitoring plan for the remedial actions is provided in Appendix B - Construction Quality Assurance Plan (CQAP), and Appendix C - Sediment Sampling Operations Manual (SSOM).

3.1 2003/2004 SEQUENCING PLAN

The 2003 RA Work Plan is based on a sequence of activities that starts in 2003 with land-based remediation, material placement, and marine demolition, followed in 2004 by marine dredging and sub-tidal transition zone grading.

The 2003 remedial action and construction activities are divided into two stages, shoreline work and marine work. The 2003/2004 sequencing for the remedial action and construction is as follows:

2003 Activities

Shoreline Work

- Pre-RA Shoreline Sediment Characterization at ATOFINA
- Bank Cleanup
- Intertidal Remediation
- Confirmation Sampling
- Materials Placement
  - Transition Zone Grading Material (TZGM)
  - Quarry Spalls & Boulders & Large Woody Debris at General Metals

Marine Work

- Hylebos Marina Partial Relocation
- ATOFINA Marine Structure Demolition

2004 Activities

- Structure Removal and Replacement
  - Kaiser outfall
  - Weyerhaeuser Log Rafting
- Dredging
- Transition Zone Grading
- Hylebos Marina Dredging and Reconfiguration

Each of the major tasks are described below.

3.2 2003 SHORELINE WORK

The 2003 shoreline work will be performed using upland-based equipment (excavators, dozers, dump trucks). The intertidal remediation will occur after the tides are out so that the excavations are completed above the water line. That way there will be no in-water work associated with the shoreline work.

The bank cleanup work is scheduled to be initiated in mid May 2003 in order to prepare portions of the site for the subsequent intertidal remediation. The intertidal excavations are scheduled during daylight periods of predicted very low tides below at least –2' MLLW to allow for sufficient work time down to and including the 0' MLLW contour. After August 12, there is not another daylight very low tide of –2' MLLW until March 2004. Consequently the intertidal excavations are scheduled to start on June 12, 2003 and be completed by the end of August to take advantage of the last days of daylight very low tides in 2003.

The 2003 shoreline work is presented on Drawing IA-1, as summarized below and then described in detail in the subsequent sections of this report.

Shoreline Work (May-August 2003)

- Sediment Characterization at ATOFINA
- Bank Cleanup
  - ATOFINA
  - General Metals Peninsula
- Intertidal Remediation
  - General Metals Graving Slip
  - J&G Boat Haul Out
  - ATOFINA Intertidal
  - Dunlap Log Haul Out
- Materials Placement
  - Transition Zone Grading Material (TZGM)
  - Quarry Spalls
  - Boulders
  - Large Woody Debris (LWD)

3.2.1 2003 Pre-RA Sediment Characterization

Surface Samples

Prior to initiation of cleanup, the following intertidal cleanup areas will be resampled to refine the extent of the intertidal area requiring cleanup:

- ATOFINA Intertidal Dock (SMA 231) Figure S-1 of SSOM

For the purpose of sampling, each of the intertidal remediation areas is divided into specific Intertidal Sampling Areas no larger than 5,000 square feet, as shown on Figure S-1 in the 2003 SSOM. Each discrete sample will be analyzed for the target parameters identified in the 2003 SSOM.

The intertidal characterization sampling results will be used to classify each intertidal sampling sub-area one of the three categories

- **Intertidal Clean**: Intertidal sampling sub-area with no analytical results exceeding the SQOs will be considered to have met the cleanup objectives of the ROD and ESD, with no remedial action required (no-action areas).

- **Intertidal Natural Recovery**. Intertidal sampling sub-areas with some analytical results which exceed the SQO, but not more that two times the SQO (450 ug/kg PCBs maximum) normally defined as natural recovery areas in accordance with the ROD and ESD. However, intertidal excavations will be completed in intertidal sampling sub-areas classified as natural recovery areas by the characterization sampling.

- **Intertidal Impacted**. Intertidal sampling sub-areas with one or more compounds exceeding 2 times the SQO (450 ug/kg PCBs) will be classified as intertidal impacted. Intertidal excavations will be completed in intertidal sampling sub-areas classified as intertidal impacted areas by the characterization sampling.

Test Pits

Test pits are planned along the ATOFINA shoreline to better characterize the nature of material to be excavated and the nature of the surface left after excavation. The excavations will be advanced by the remediation contractor utilizing the excavator equipment mobilized to the site for the cleanup, and will extend to the depth of excavation indicated on the cross sections of the project drawings.

The materials exposed in the walls and floor of each test pit will be described in a field log. The nature and extent of exposed debris will be qualitatively described, along with the grain-size characteristics of the soil matrix.

Two soil samples will be collected from the test pits along the ATOFINA shoreline shown on Figure S-1 to represent the material that will be exposed by the intertidal remediation. The samples will be collected near elevations 5' and 10' MLLW of the anticipated final surface. One sample will be collected from the ATOFINA test pits shown on Figure S-2 at the elevation exposed by the bank cleanup process. The samples will be submitted for analytical testing described in the SSOM.

The test-pit sampling results will be used to determine if any revisions will be required to the 2003 RA Work Plan, as follows:

- **No Revisions to Work Plan**: Test-pit sampling sub-areas with no analytical results exceeding the SQOs will be considered to have met the cleanup objectives of the ROD and ESD, with no revisions required to the 2003 RA Work Plan.

- **Work Plan Addendum**. Test-pit sampling sub-areas with some analytical results that exceed some of the SQOs will require a work plan addendum to be submitted to EPA within 30 days of receipt of the data. The work plan addendum will be for evaluating and developing a revised cleanup approach for the effected sub-areas, with the revised cleanup to be completed no later than the end of the 2004 construction season.

Schedule

The sampling is scheduled to be completed between May 15 and May 20, 2003, a time when daylight low tides range from -1.9 feet to -3.5 feet below mean sea level.

3.2.2 2003 Bank Cleanup

Construction debris and creosote-treated timber bulkheads have been observed along the face of some of the banks. Typically the bank material is found between the top of the bank (typically elevation +17' to +18') extending in some cases down to elevation 0' MLLW.

ATOFINA and General Metals have identified portions of their shoreline banks that will be cleaned up and stabilized to limit the future potential of erosion of unsuitable materials onto the shoreline. These areas are shown on attached Drawing IA-1with yellow shading. The bank cleanup activities will extend from the top of the bank to typically high intertidal elevations (+7' MLLW and higher), and in some cases down to 0' MLLW.

The portions of the banks located above +12' MLLW will be cleaned up prior to the intertidal remediation. Portions of the bank that are located lower than +12' MLLW will be cleaned up after the adjacent intertidal remediation is complete, so as to avoid contamination of the bank materials. If material suspected of chemical contamination is encountered in the bank excavations, such as stained soil or waste containers, it will be separated from the bank material and handled appropriately.

The estimated volume of material to be removed by the bank cleanup actions is summarized below in Table 3-1.

Table 3-1. Bank Cleanup Areas & Volumes at Head of Hylebos Waterway

Location	SMA Area	Size (Acres)	Estimated Excavation Volume, cy
ATOFINA	221	2.8	29,200
General Metals	203	0.6	4,700
TOTAL		4	33,900

The bank cleanup areas have the potential to generate roughly 33,900 cubic yards of excavated material. The scope of the bank cleanup at the ATOFINA and General Metal properties is described below.

3.2.2.1 ATOFINA Bank Cleanup

The top of the bank along the ATOFINA property, except for at the dock, will generally be pulled back to flatten out the over-steepened slope. East of the ATOFINA dock the bank cleanup will result in the top of the bank being pulled back on the order of ten feet. There is an existing sheet-pile wall associated with site groundwater control at the site. The wall will not be disturbed by the bank cleanup. West of the ATOFINA dock, extending to the property line with Thermafiber, the top of the bank will be pulled back 60 to 120 feet[2], resulting in the creation of a high intertidal bench. At the location of the new top of bank, the existing ground will be cut down at about a 2H:1V slope to elevation +9' MLLW, and then at a very flat slope (10H:1V) until it daylights with the existing slope. This bank cleanup will remove old construction debris (bricks, concrete, etc.) that have been exposed by shoreline erosion or accumulated along the shoreline over the years, as well as remove the intertidal timber bulkheads along the property. The surface of the resulting bank pullback will be dressed with a one to two-foot blanket of Transition Zone Grading material to establish a smooth slope free of depressions that might otherwise result in entrapment of juvenile salmonids or other fish with a falling tide.

Bank cleanup along the ATOFINA property will result in an estimated removal volume of 29,200 cy. The material excavated to complete the ATOFINA bank cleanup will be screened to remove oversize debris and then relocated to another location on the ATOFINA property away from the shoreline or depending on space availability, transported for landfill disposal. The placement location is shown on Drawing AU-3.

3.2.2.2 General Metals Peninsula Bank Cleanup

The top of the peninsula along the General Metals graving slip will be excavated down to about elevation +7.5' MLLW to remove previously placed fill containing debris that might

[2] A portion of this action may be delayed until after the dredging in order to maintain the salt pads in working order as part of the contingency actions discussed in Section 7.5.

otherwise eventually erode onto the beach. The newly exposed surface of the excavation will be stabilized with a 1.5 foot thick layer of quarry spalls, covered by a one-foot thick layer of Transition Zone Grading material. The quarry spalls will extend from the crest to elevation 0' MLLW on the outboard side of the peninsula only (1,200 cy estimated). The entire peninsula will then be blanketed with a one-foot thick layer of Transition Zone Grading material.

Two staggered rows of roughly four-foot diameter boulders (naturally rounded rock, not quarry rock) will be placed on approximate six-foot centers along the top of the peninsula to diffuse wave action at high tide. Large woody debris will be integrated within the rocks

Excavation for bank cleanup at the General Metals facility will result in an estimated removal volume of 4,700 cy. The excavated material will be transported for landfill disposal due to lack of available space at the General Metals facility.

3.2.3 2003 Intertidal Remediation

The SOW identifies the sediment management areas ("SMAs") to be remediated at the Head of Hylebos Waterway Problem Area, which are depicted in Figure 1-2. The SMAs to be remediated during 2003 are limited to the intertidal sediment remedial action areas listed below.

Table 3-2. Intertidal Excavation Areas & Volumes at Head of Hylebos Waterway

Site	SMA Area	Size (Acres)	Estimated Excavation Volume, CY
NORTH SHORELINE			
General Metals	203	0.4	2,100
J&G	142	0.2	1,100
SOUTH SHORELINE			
ATOFINA Intertidal	221	0.7	3,100
Dunlap – Log Haul out	242	0.2	1,100
TOTAL		1.5	7,400

These areas are shown on attached Drawing IA-1 with light green shading.

Intertidal remediation addresses the portions of the site located between elevations 0 and +12' MLLW. The isolated intertidal areas have the potential to generate approximately 7,400 cubic yards of excavated material based on an estimated three-foot average depth of excavation.

The intertidal remediation will be divided into two stages:

- North shoreline consisting of the General Metals graving slip and the J&G property.
- South shoreline consisting of the ATOFINA intertidal and Dunlap log haul out area.

The north shoreline is scheduled for completion during the low tides of June 2003 and the south shoreline during the low tides of July 2003.

3.2.3.1 General Metals Graving Slip, North Shoreline (SMA 203)

The graving slip is classified as a natural recovery area in the Evaluation Report and the 2000 ESD. One sample, 2212I, was collected in the area with low exceedance factors (1.5 or less) of the SQOs for two compounds, arsenic (EF = 1.5) and PCBs (EF=1.17). All three bioassay tests (Amphipod, Larval, *Neanthes*) passed for the sample. However, in accordance with the Implementation Strategy for the Head of Hylebos Waterway (Section 3 of the Basis for Design Report[3]), the area will be removed by excavation rather than leaving it for long-term recovery. This intertidal area is roughly 100 ft. by 350 ft. (0.8 acres) in size, located adjacent to the navigation channel at roughly station 128. The intertidal slope is on the order of 40H:1V. The excavation will not undermine the side slopes that extend into the graving dock from the uplands. Excavation will result in an estimated removal volume of 2,100 cy. The duration of the remedial action in this area will take on the order of a week to complete.

3.2.3.2 J&G Boat Haul-Out, North Shoreline (SMA 142)

This isolated intertidal area is about 150 feet wide and 150 feet long, between navigation channel stations 160+00 and 161+50, along the north bank of the upper turning basin. The intertidal slope is on the order of 1.5 to 2.25H:1V. The property includes a boat haul-out structure that extends from the upland out over the subtidal sediments at a slope of 16H:1V. One intertidal composite sample (1212I) in SMA 142 exceeds the ROD cleanup criteria for two compounds, dimethyl phthalate (EF = 2.94J) and copper (EF = 2.36). An adjacent shallow subtidal sample (1122S) passes the cleanup criteria. As summarized in Section 3.4, and detailed in the 2003 SSOM, additional characterization is planned for this area prior to the remedial action to refine the extent of intertidal area requiring cleanup. Excavation will result in a currently estimated removal volume of 1,100 cy. The duration of the remedial action in this area will take on the order of three days to complete.

3.2.3.3 ATOFINA Intertidal, South Shoreline (SMA 221)

This 750-foot long intertidal area extends eastward from the ATOFINA dock to the Eastside ditch, between navigation channel stations 123+25 to 130+75. This intertidal location is part of a larger subtidal cleanup area (SMA 221) that extends throughout the Middle Turning Basin of Hylebos Waterway. The intertidal slopes range from near vertical, retained behind creosote timber bulkheads, to on the order of 3H:1V. One intertidal composite sample (2206I) extends over the distance, and one source material sample (2203 SM) covers the

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[3] Draft (90%) Final Design Deliverable & Basis for Design Report. Head of Hylebos Waterway Problem Area. Commencement Bay Nearshore / Tideflats Superfund Site. Tacoma, Washington. Dalton, Olmsted & Fuglevand, Inc. December 16, 2002.

eastern ½ of the area. As shown on Figure 2-1a, there is a mixture of metals and organic parameters that exceed the SQO criteria at this location. Remediation will involve removal of impacted sediment as well as creosote timber structures of the intertidal area. Excavation will result in an estimated removal volume of 3,100 cy. It is expected to take five to seven days to complete.

3.2.3.4 Dunlap Log Haul Out Ramp at ATOFINA, South Shoreline (SMA 242)

This isolated intertidal area is about 125 feet wide and 125 feet long, centered roughly at navigation channel station 136+50, along the southwest bank of the waterway. One intertidal composite sample (2209I) in SMA 242 exceeds the ROD cleanup criteria for one compound, arsenic (EF=1.96). The intertidal slope is on the order of 5H:1V. SMA 242 is located at the log haul-out ramp of the former Dunlap Towing log yard. As summarized in Section 3.4, and detailed in the 2003 SSOM, additional characterization is planned for this area prior to the remedial action to refine the extent of intertidal area requiring cleanup. Excavation will result in a currently estimated removal volume of 1,100 cy. The duration of the remedial action in this area will take on the order of three days to complete.

3.2.4 2003 Excavated Material Disposal

Excavated intertidal remediation material will be loaded onto trucks and/or rail cars provided and operated by the landfill, and transported by the landfill to a regional landfill for disposal. The transportation and disposal of the excavated material in the landfill is covered by the solid waste handling permit under WAC 173-351. The good-standing of the landfill will be verified prior to initiating disposal through the EPA's contact person for the off-site rule. HHCG plans to retain the Regional Disposal Company (RDC) for transportation and disposal of Head of Hylebos material.

The RDC has a demonstration project in place that allows material excavated from the waterway to be used as part of a two-year moisture enhancement program at the Roosevelt Regional Landfill. The program is intended to refine methods for introducing water into the landfill to enhance decomposition and increase gas production. Because dredged material is to be used for moisture enhancement, no paint filter testing is required for dredged materials placed into the landfill as part of the demonstration program.

RDC also has a cooperative agreement in place with the Land Recovery, Inc. (LRI) landfill in Pierce County. RDC may direct some of the dryer excavated soil, creosote treated timber, and other demolition debris to the LRI landfill if it is more efficient and cost effective for the project. Material delivered to LRI will be required to pass the paint filter test criteria.

Excavated intertidal remediation material will either be placed directly into trucks for delivery to RDC's transfer station or the LRI landfill, or will be stockpiled on site within the confines of the asphalt-paved salt pads at ATOFINA for subsequent loading onto railcars for delivery to the Roosevelt Regional Landfill.

3.2.5 2003 Shoreline Transition Zone Grading

The surface of the shoreline resulting from intertidal remediation and bank cleanup will be dressed with a one to two-foot blanket of Transition Zone Grading Material (TZGM) to establish a smooth slope free of depressions that might otherwise result in entrapment of juvenile salmonids or other fish with a falling tide. The Transition Zone Grading material will also improve the erosion resistance of the shoreline to reduce the rate of ongoing bank loss. TZGM will not be placed on Intertidal Remediation areas until confirmation sampling establishes that the cleanup is complete (see CQAP).

The Transition Zone Grading material will be a well-graded sand and gravel material composed of naturally rounded rock (no crushed rock). Two potential sources of the material are:

- Sand and gravel pits located near the Head of Hylebos Waterway. Material from these pits was used for the Ace Tank cleanup on Hylebos Waterway.
- Glacier Pioneer Aggregate Plant #1 (Dupont, WA area) material that was used as habitat mix by the City of Tacoma for the Thea Foss Esplanade project.

The grain size criteria for the Transition Zone Grading material is as follows:

Table 3-3 . Grain Size Criteria for Transition Zone Grading

Sieve Size	*Percent Passing*
6" square	100%
US No. 4	80% max
US No 40	50% max
US No. 200	10% max

EPA will be notified to inspect and approve the source of Transition Zone Grading material before it is imported to the site.

The estimated volume of Transition Zone Grading material to be used during the 2003 work is summarized below.

Table 3-4. Transition Zone Grading Volumes at Head of Hylebos Waterway

Location	SMA Area	Estimated Volume, cy
General Metals	203	2,800
J&G	142	600
ATOFINA Intertidal	221	8,500
Dunlap – Log Haul out	242	600
TOTAL		12,500

3.3 2003 MARINE WORK

The 2003 Marine Work will occur using water-born equipment (derrick, haul barges, tug boats, work boats). The marine work will be delayed to as late as possible in 2003 in order to provide time to complete the permitting process (see Section 4.5.2). In order to keep the Superfund cleanup project on schedule, the 2003 marine work should start no later than October 15, 2003 so it can be completed by the February 15, 2004 fish-window closure.

Each of the major 2003 Marine Work tasks are described below.

3.3.1 2003 Hylebos Marina Partial Relocation

The 2004 dredging plan has been specifically designed to provide for an ongoing functioning of Hylebos Marina. Completing the necessary marina moves and waterway dredging in a single 2004 season requires that specific preparations be made for the work in 2003. Specifically, the 2003 work calls for the following Hylebos Marina actions:

- Boathouse Relocation. The current configuration of Hylebos Marina is presented on Figure M-1. In 2003 the eastern-most portion of the marina will be relocated to other areas of Hylebos Marina as shown on Figure M-2. The purpose of this relocation in 2003 is to clear the eastern 2/3 of the Middle Turning Basin for dredging at the start of the 2004 in-water construction season. The installation of approximately 10 to 15 temporary (1 year or less) piling will be required to anchor the boathouses in the new location. (Work to be completed by Hylebos Marina)

- Travelift Pier Construction. The existing travelift pier, as shown on Figure M-1, will be removed as part of the 2004 dredging action. Consequently a new travelift pier will be constructed during 2003 at the location shown on Figure M-2 to provide for uninterrupted travelift operations during the cleanup. (Work to be completed by Hylebos Marina)

- Barge Dock Removal. The existing barge dock and associated pile foundation as shown on Figure M-2 will be removed in 2003 at the time of the construction of the travelift pier. (Work to be completed by Hylebos Marina)

This work will be completed during the normal in-water construction window in conjunction with the marine demolition along the ATOFINA property described below.

3.3.2 2003 ATOFINA Marine Demolition

Drawing D-2 identifies the shoreline structures scheduled for removal in 2003. The in-water structures will be removed using marine-based equipment operating during the normal in-water construction window. The in-water structures along the ATOFINA shoreline shown on Drawing D-2, moving from left to right, are as follows:

- Diffuser Pier (concrete pile structure)
- Salt Pier (creosote-treated timber structure)
- Rail Road Trestle Bents (steel and concrete structures – may be shifted to 2004 because of proximity to existing ATOFINA dock)

3.4 2003 NATURAL RECOVERY MONITORING

The natural recovery designation indicates areas that the pre-remedial design determined would recover without any active remediation of the sediments over a period of ten years following completion of the remedial action. As part of the 2003 work, the Weyerhaeuser natural recovery area (SMA 102) will be sampled to characterize the current status of the area. The sampling program is presented in the 2003 SSOM.

3.5 2003 CONTRACTOR SUBMITTALS

Contracting for the 2003 remedial action activities will occur in two phases, shoreline work and marine work, as follows:

2003 Shoreline Work Contract
- Intertidal Remediation
- Bank Cleanup
- Material Placement, including Shoreline Transition Zone Grading

2003 Marine Work Contract
- Hylebos Marina Partial Relocation
- ATOFINA Marine Structure Demolition

The contractor submittals are presented in the 2003 CQAP and summarized in Table 3-5.

Table 3-5. Contractor Submittals from the 2003 CQAP

Construction Element	Submittal Required	From	Due
General	Certificates of Insurance	ALL CONTRACTORS	10 days after project award
Health and Safety	Site Health and Safety plan	Remedial Action Contractor	10 days after project award
	Health and Safety and Medical training records	Remedial Action Contractor	Prior to start of construction
Transport and Disposal	Workplan	Transportation and Disposal Contractor	10 days after project award
	Daily Tonnage summary	Transportation and Disposal Contractor	Daily
	Weekly Transportation and Disposal Summary	Transportation and Disposal Contractor	Weekly
Shoreline Excavations (J & G Property, GM Graving Slip, ATOFINA Shoreline) and Demolition	Work plan	Remedial Action Contractor	10 days after project award
	CQC Plan	Remedial Action Contractor	10 days after project award
	Environmental Protection Plan (EPP)	Remedial Action Contractor	10 days after project award
	Project Schedule	Remedial Action Contractor	10 days after project award, updated weekly during RA
	All contractor performed surveys	Remedial Action Contractor	Within 2 days of survey

Once each contract is awarded, those documents will be submitted for insertion behind the specific tabs included at the end of this document.

3.6 2004 ACTIVITIES

While the 2004 remedial actions are not part of the 2003 RA Work Plan, a general description of those activities is provided here as an overview of the full project.

3.6.1 2004 Structure Removal and Replacement

Structures on three aquatic properties will be removed to allow for dredging, and then replaced following the cleanup. The structures are:

- Hylebos Marina (discussed above in 2003 Hylebos Marina)
- Kaiser Outfall
- Weyerhaeuser Log Rafting Area

The Kaiser and Weyerhaeuser structure removal is scheduled to occur during the first month of the 2004 construction window to make the areas available for dredging as soon as the first phase of the Middle Turning Basin dredging is complete.

A fourth structure is located at General Metals. A marine outfall extends from the shoreline of the General Metals property out across the mouth of the graving slip into Hylebos Waterway. Two options are currently under consideration for the diffuser with regards to the 2004 dredging. The first would be to temporarily remove the outfall and replace it following dredging. The second would be to leave it in place, with dredging setbacks in combination with Transition Zone Grading. The selected option for the outfall will be presented in the 2004 final design package.

3.6.2 2004 Dredging

Mechanical dredging has been selected for the Head of Hylebos Waterway to facilitate transportation and placement into the selected upland disposal site. The Hylebos sediments to be dredged are fine-grained silts and clays.

The dredging plan will incorporate best-management-practice (BMP) components to reduce the potential for recontamination of remediated areas due to sloughing from adjacent impacted material, and to limit the development of a contaminated fluff layer above the native sediments. The thicker deposits of impacted material (ten to fifteen feet thick) found outside the navigation channel will be dredged first using a mechanical dredge with a conventional clamshell bucket outfitted with an accurate bucket positioning system, taking care to leave a more uniform, and relatively level two to three foot thick layer of impacted material throughout the cleanup area. A second dredging pass will thereafter be made using a precision excavator dredge configured with a sealed horizontal profiling bucket to remove the remaining impacted sediment down to native material. The reduced bank height for the second pass will decrease the chance of recontamination of dredged areas from bank sloughing and facilitate a more efficient and accurate final dredge pass.

3.6.3 2004 Sub-tidal Transition Zone Grading

The marine dredging areas generally daylight near the top of the slope along the shoreline. However, this cannot occur along existing structures (Structure Transition Zone) or at the ends of the project (End Transition Zone). At these locations the final dredge cut slope will be dressed with sand and gravel to stabilize the face. This Transition Zone Grading will generally consist of a 25-foot wide by 3-foot thick blanket of sand and gravel placed along and over the length of the dredge cut. The material used for transition zone grading will be the same material specified for 2003 Shoreline Transition Zone Grading.

Within 15 feet of structures (Structure Transition Zone), the depth of cut and transition slope will be limited to protect structure stability. The cut depths within the Structure Transition Zone will be three feet or less and will be backfilled with Transition Zone Grading material following the second pass dredging.

4 SUBSTANTIVE REQUIREMENTS AND PERMITS

The ROD and the 2000 ESD determined that the selected remedy - source control, natural recovery, and sediment confinement by capping or dredging with confined disposal - complies with federal, state, and tribal requirements that are applicable or relevant and appropriate for the remedial action (Applicable, or Relevant and Appropriate, Requirements – "ARARs"). Consequently permits are not required for the remedial actions and construction completed under Superfund authorization.

As discussed below in Section 4.5.2, permitting is required for construction and reconfiguration of portions of the Hylebos Marina that will be permanently changed due to the remedial action

The substantive requirements and permits associated with the 2003 work are discussed below.

4.1 ACCESS AGREEMENTS

With the exception of actions at the J&G Marine site (Way Conn Properties) and Hylebos Marina facility, all of the 2003 work will be competed on property owned by HHCG members (General Metals of Tacoma and ATOFINA). Consequently 2003 access agreements are only required from Way Conn Properties and Hylebos Marina. The access authorizations for those properties are provided in Appendix E (will be provided once obtained for insertion into the document at Tab E)

4.2 CWA SECTION 401

Section 401 of the Clean Water Act (CWA) requires that both dredging and dredged material disposal operations not violate applicable water quality standards. The information provided in the Evaluation Report and the 2000 ESD demonstrates that the recommended remediation plan is not expected to violate applicable water quality standards, and therefore complies with the substantive requirements of Section 401 of the CWA.

The 2003 shoreline work will occur using upland-based equipment (excavators, dozers, dump trucks), and will only occur after the tides are out so that the excavations are completed above the water line. There will be no in-water work associated with the shoreline work. The 2003 marine work (marina relocation and structure demolition) will occur with water-borne equipment during the July 16 to February 14 in-water construction window.

The need for any water-quality monitoring will be established in EPA's Water Quality Certification for the 2003 work.

4.3 CWA SECTION 404

This act regulates the discharge of fill material into waters of the United States. Under the Section 404(b)(1) Guidelines, discharges of fill material may be permitted if there is no practicable alternative to the proposed discharge that would have a less adverse impact on the aquatic ecosystem, so long as the alternative does not have other significant adverse impacts. As part of the Head of Hylebos cleanup, Transition Zone Grading material will be placed into waters of the United States (Head of Hylebos Waterway). The materials placement (Transition Zone Grading, quarry spalls, boulders, and LWD) is part of the cleanup plan. The evaluations presented in the Evaluation Report and the findings of the 2000 ESD demonstrate that:

- The recommended remediation plan will not cause or contribute to, after consideration of site dilution and dispersion, violations of any applicable state water quality standard.

- The recommended remediation plan will not violate any applicable toxic effluent standard or prohibition under CWA Section 307.

- The recommended remediation plan is expected to provide habitat benefits for threatened Puget Sound chinook salmon by improving habitat quality. Further, the recommended remediation plan will not jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of critical habitat.

- The recommended remediation plan will not contribute to significant degradation of the waters of the United States.

4.4 ENDANGERED SPECIES ACT (ESA)

The listing of Puget Sound chinook salmon and bull trout as threatened species under ESA required EPA to evaluate habitat impacts and habitat enhancement opportunities as part of the CB/NT cleanup plan. EPA identified appropriate measures to avoid and minimize adverse impacts to the Commencement Bay aquatic environment. EPA concluded that CB/NT cleanup plan is not likely to jeopardize the continued existence of any federally listed threatened or endangered species or result in the destruction of or adverse impacts to critical habitat for these species, and thereby complies with the ESA. Specifically for Hylebos Waterway, EPA's 2000 ESD determined that 1) the dredging and cleanup activities would leave much less contaminated bottom sediment, which is expected to result in improved habitat quality throughout the waterway; 2) mitigation would be required for any loss of aquatic habitat, with specific emphasis on loss of intertidal habitat; 3) in-water work is to avoid fish-critical activity periods; and 4) "best design" features and/or materials are to be incorporated into remediation plans to protect ESA-listed species.

EPA has initiated informal consultation with the NOAA Fisheries (Robert Clark) and U.S. Fish and Wildlife Services (Gwill Ging) regarding the Head of Hylebos cleanup project, including Hylebos Marina. Based on that consultation, Appendix D has been prepared in support of ongoing informal consultation for the 2003 Work.

Formal ESA consultation regarding the 2004 work is also scheduled to be initiated and completed in 2003. A formal consultation on the 2004 work will be addressed by a separate BA Addendum provided under separate cover to EPA by March 28, 2003. In order to meet the goal of obtaining the Hylebos Marina Corps permits by September 30, 2003 (see Section 4.5.2) the formal ESA consultation should start no later than June 2003.

Ongoing conversations between Hylebos Marina, the Corps, and EPA are aimed at taking full advantage of the ESA work already underway through the Superfund process in order to streamline the Corps permitting process for Hylebos Marina, as discussed below.

4.5 RIVERS AND HARBOR ACT

4.5.1 Excavation, Transition Zone Grading, Structure Demolition:

The Rivers and Harbor Act prohibits unauthorized activities that obstruct or alter a navigable waterway. In particular, Section 10 of the Act applies to any dredging or disposal activity in navigable waters of the United States. Authorization of such activities follows a public interest review of the proposed activity. The recommended remediation plan involves shoreline excavation with transition zone grading, which will not impact the navigation channel, as well as demolition of existing structures that are located outside of the navigation channel. The ROD and the 2000 ESD determined that the cumulative negative effects of the cleanup activities in the navigation channel, when balanced against the benefits of substantial reduction in risk to human health and the environment, were in the public interest. The excavation, transition zone grading, and structure demolition work complies with the substantive requirements of the Rivers and Harbors Act.

4.5.2 Hylebos Marina

As described in Section 3.3.1, relocation and reconstruction of the Hylebos Marina is required to facilitate the required remedial action dredging in 2004. The sequence of relocations, construction, and remedial actions are presented on Figures M-1 (existing marina configuration) through M-8 (final marina configuration). The sequence of actions at Hylebos Marina is summarized below.

- 2003 Temporary Boathouse Relocation. The current configuration of Hylebos Marina is presented on Figure M-1. The eastern-most portion of the marina will be relocated to other areas of Hylebos Marina as shown on Figure M-2. The purpose of this relocation in 2003 is to clear the eastern 2/3 of the Middle Turning Basin for dredging at the start of the 2004 in-water construction season. The installation of approximately 10 to 15 temporary (1 year or less) piling will be required to anchor the boathouses in the new location.

- 2003 Travelift Pier Construction. The existing travelift pier at Hylebos Marina will be removed as part of the 2004 dredging action. Consequently a new travelift pier will be constructed during 2003 at the location shown on Figure M-2 to provide for uninterrupted travelift operations during the cleanup.

- 2003 Barge Dock Removal. The existing barge dock and associated pile foundation shown on Figure M-2 will be removed at the time of the construction of the travelift pier.

- 2004 Permanent Boathouse Relocation: Following dredging of the area shown on Figure M-3, the boathouses and associated floats and guide piles will be permanently relocated to a new location in the Middle Turning Basin, as shown on Figures M-4 and M-5. No creosote-treated timber piles will be used for the relocation. Following the relocation, the existing 79 creosote-treated timber piles (guide piles and travelift pier) will be permanently removed, as shown on Figure M-6. That area will then be dredged as shown on Figure M-7 to complete the removal action portion of the work at Hylebos Marina.

- 2004/2005 Construction of Open-Moorage Boat Slips. Following completion of the removal action, the marina will be fully re-established with the re-construction of the travelift pier at the original location shown on Figure M-1 and construction of open moorage boat slips as shown on Figure M-8.

Hylebos Marina relocation actions are a necessary component of the remedial actions being implemented in the Hylebos Waterway and this work is being conducted within the Superfund Site boundaries. Accordingly, consistent with CERCLA section 121(e), the procedural obligation to obtain any required permits is not necessary to conduct this work. Respondents must however comply with the substantive requirements related to the permits. Respondents are directed to perform this work regardless of whether any permits are obtained prior to initiating this work. However, because work will result in re-configuration of portions of the Hylebos Marina, EPA understands that the Army Corps of Engineers may require that the Marina obtain permit(s) under Section 10 of the Rivers and Harbors Act should the Marina intend that the re-configurations be permanent. Regardless, failure to obtain permits for marina relocation will not be a basis for the HHCG to delay the channel dredging beginning July 15, 2004 since work can proceed under Superfund as needed to complete the dredging.

Hylebos Marina is currently working with the Corps to obtain a permit for the final marina configuration shown on Figure M-8 by September 30, 2003. The permit would address both the 2003 and 2004 new construction as summarized below:

2003 Work

- New travelift, see Figure M-2
- Guide piles for temporary boathouse relocation, see Figure M-2
- Removal of Barge Dock, see Figure M-2

2004/2005 Work

- Relocated Boathouse Storage, see Figure M-8
- Relocated and new open moorage boat slips, see figure M-8
- Reconstruction of original travelift, see Figure M-1 and M-8

In order to keep the Superfund cleanup project on schedule, the 2003 Marina work should start no later than October 15, 2003 so it can be completed by the February 15, 2004 fish-window closure.

In order to assist the Corps permit process, the required Endangered Species Act (ESA) documents (Biological Assessment, "BA", and BA Addendum) for Head of Hylebos cleanup project also included the Hylebos Marina relocation and reconstruction, as described in Section 4.4 on ESA.

5 2003 SCHEDULE

This section of the 2003 RA Work Plan provides the schedule for each discrete remedial action and construction element as well as the schedule of associated deliverables.

5.1 2003 CONSTRUCTION WINDOW

5.1.1 2003 Shoreline Work

As part of the habitat conservation measures for the project, the intertidal remediation will occur using upland-based equipment (excavators, dozers, dump trucks) after the tides are out so that the excavations are completed out of the water. There will be no in-water work associated with the intertidal remediation. For worker safety reasons, this approach requires that the excavations occur during daylight periods of very low tides that reach at least –2' MLLW to allow for sufficient work time down to and including the 0' MLLW contour. After August 12, there is not another daylight very low tide of –2' MLLW until March 2004. Consequently the intertidal excavations are scheduled as follows:

- June 12-17, 2003: -2.1' to –3.9' MLLW (6 days)
- June 30 – July 2, 2003: -2.0' - -2.2' MLLW (2 days)
- July 11-15, 2003: -2.6' to -3.5' MLLW (5 days)
- July 29: -2.0 ft. MLLW (1 day)
- August 9-12: -2 ft to -2.4 ft. MLLW (4 days)

5.1.2 2003 Marine Work

Completing the necessary marina moves and waterway dredging in a single 2004 season requires that specific preparations be made for the work in 2003. Specifically, the 2003 marine work involves construction of a new travelift pier and relocation of some boathouses at Hylebos Marina, as well as demolition of some ATOFINA structures. For the sake of project and economic efficiencies, all 2003 marine work is being issued under a single contract.

The 2003 work at Hylebos Marina is not scheduled to start until the required permits are received from the Corps so that structures can remain in place permanently after completion of the Superfund action. Consequently, the 2003 marine work is being shifted to as late in the 2003 construction window as possible to provide sufficient time to complete the permitting process. Recognizing that piles have to be purchased and components fabricated before the travelift pier can be constructed, the permits for Hylebos Marina should be in place by September 30, 2003 to allow sufficient time to complete the travelift before the February 15, 2004 fish window closure.

Based on the above analysis, the construction window for the 2003 marine work will be from October 1, 2003 through February 15, 2004.

5.2 2003 CONSTRUCTION CONTRACT SCHEDULES

5.2.1 2003 Shoreline Work Contract

With EPA approval of this 2003 RA Work Plan, 2003 Shoreline Work contract will be procured under the following schedule:

1. Issue Request for Proposals (RFPs) by April 1, 2003 RFPs will be issued to the following three contractors, all with Superfund experience specifically related to the nature of the 2003 shoreline work;

   - CE Con of Tacoma, Washington
   - Envirocon of Portland, Oregon
   - Wilder Construction of Everett, Washington

   EPA will be asked to approve the list of pre-qualified contractors prior to issuing the RFP.

2. Receive RFPs by April 15, 2003. The RFPs will be reviewed by the HHCG to identify a short list of contractors to interview for the work.

3. Interviews week of April 21, 2004. Contractors will be interviewed as part of the selection process.

4. Contractor Selection by April 25, 2003. The preferred contractor will be selected by the HHCG by April 25, 2003. EPA will be immediately notified and the HHCG will request approval of the selected contractor by April 28, 2003.

5. Award 2003 Shoreline Contract April 30, 2003.

6. Pre-Construction Meeting May 5, 2003. The pre-construction meeting for the 2003 shoreline contract will be May 5, 2003.

7. Initiate Shoreline Construction May 15, 2003. The contractor will be directed to proceed with the 2003 shoreline work by May 15, 2003.

5.2.2 2003 Marine Work Contract

With EPA approval of this 2003 RA Work Plan, the procurement of the 2003 Marine Work contract will be based on the following schedule:

1. Establish Pre-Qualified Contractors by July 15, 2003. The HHCG and Hylebos Marina will establish a list of pre-qualified contractors to receive the RFP for the marine work contract. EPA will be asked to approve the list of pre-qualified contractors prior to issuing the RFP.

2. Issue Request for Proposals (RFPs) by August 1, 2003 RFPs will be issued to the pre-qualified contractors.

3. Receive Proposals by August 29, 2003. The RFPs will be reviewed by the HHCG and Hylebos Marina to establish a short list of contractors to interview for the work.

4. Interviews week of September 8, 2003. The short-listed contractors will be interviewed as part of the selection process.

5. Contractor Selection by September 15, 2003. The preferred contractor will be selected by the HHCG and Hylebos Marina by October 15, 2003. EPA will be immediately notified and the HHCG will request approval of the selected contractor by September 17, 2003.

6. Corps Issue Section 10 Permit for Hylebos Marina by September 30, 2003. Hylebos Marina has stated that the new travelift pier will not be constructed without a Corps permit, due to the significant financial investment associated with construction. The status of the permit process will be tracked during the course of 2003. If complications develop with the permit, the EPA, HHCG, Hylebos Marina, and the Corps will coordinate to develop alternative plans.

7. Award 2003 Marine Contract October 3, 2003. Once awarded, the contractor will be directed to immediately order piles for the new travelift pier. Issuing the contract will be conditioned on having a Corps permit for the Hylebos Marina work.

8. Pre-Construction Meeting October 14, 2003. The pre-construction meeting for the 2003 marine contract, as required under the UAO, is tentatively scheduled for October 14, 2003.

9. Initiate Marine Construction October 15, 2003. The contractor will be directed to proceed with the 2003 shoreline work effective October 15, 2003.

5.3 2003 SCHEDULE OF MEETINGS AND DELIVERABLES

The documentation and reporting of the 2003 remedial action is detailed in the 2003 CQAP, and is summarized below:

5.3.1 2003 Progress Meetings and Inspections

- Preconstruction Inspection Meeting, within 15 days after contract award, currently scheduled for May 5, 2003 for the shoreline contract, and for October 14, 2003 for the marine contract.
- RA Briefings and Progress Meetings – weekly unless EPA and HHCG agree to a less frequent, schedule. The specific dates and times of the meetings will be established at the time of each preconstruction inspection meeting.
- Prefinal Construction Inspection: within 30 days after completion of a discrete element of the remedial action.
- Final Construction Inspection Within 30 days aft4er completion of any work identified in the prefinal inspection reports.

5.3.2 2003 Progress Reports

<u>Contractor to HHCG</u>

- Daily production and quality control reports.

<u>Landfill to HHCG</u>

- Scale tickets of all material delivered to landfill
- Weekly reporting of tons disposed per day by container.

<u>Construction Oversight by CQAO to EPA</u>

- Weekly Quality Assurance Report
- Change Orders
- Prefinal Construction Inspection Letter, 7 days after prefinal construction inspection of each discrete element of the remedial action
- Final Construction Inspection Letter, no later than 30 days after each final construction inspection meeting.

5.3.3 Remedial Action Construction and Completion Reports

The SOW referenced RA Construction Report and RA Completion Report will be prepared and submitted once the construction is complete for all discrete remedial action elements for the cleanup, including both the 2003 and 2004 actions.

5.4 2003 SCHEDULE OF DISCRETE ELEMENTS

The attached Figure 5-1 is a bar chart that presents the major elements of the 2003 RA Work Plan. The elements are divided into three subsets, as indicated by different colors of the schedule bar as follows:

2003 Design and Authorization Tasks (red bars)

- HHCG Submit 2003 RA Work Plan. This task is shown with the scheduled delivery date of the work plan, March 21, 2003.

- EPA Approve RA Work Plan. This task is shown as completed by April 28, 2004. Approval of the RA Work Plan by this date is necessary to keep the shoreline work on schedule to take advantage of the few daylight very low tides left in the year for the intertidal remediation.

- ESA Formal Consultation. This 90-day task is shown starting in mid June, 2003 and completed in mid September, 2003. Completion of the task on this schedule is needed to facilitate the Corps permit schedule for Hylebos Marina.

- Corps Hylebos Marina Permit. This six-month task is shown starting the first of April, with the Section 10 permit issued by the end of September, 2003. The permit is required for multiple permanent reconstruction and reconfiguration activities at Hylebos Marina to support the cleanup project.

2003 Shoreline Construction (blue bars)

- Shoreline Contractor selection process (April 1 – April 25, 2003)
- Shoreline Pre-construction meeting (May 5, 2003)
- Shoreline Characterization Sampling (May 15 - May 20, 2003)
- Shoreline periods of very low tides (June 12 – August 12, 2003)
- Shoreline construction activities (May 15 – August 30, 2003)
- Shoreline pre-final construction inspection, low tides (August 25 – August 27, 2003)

2003 Marine Construction (green bars)

- Marine Contractor selection process (July 15 – September 12)
- Marine Pre-construction meeting (October 3, 2003)
- Marine construction activities (October 15, 2003 – February 14, 2004)
- Marine pre-final construction inspection (February 8 – 14, 2004)

6 2003 CONTINGENCY ACTIONS

The following are contingency actions to supplement, as needed, the planned removal action at the Head of Hylebos Waterway.

6.1 GRADING

Transition Zone Grading is part of the 2003 action along the shoreline to match existing conditions adjacent to the excavation by placing a blanket of sand and gravel along the edge of the cut. As a contingency action, similar grading activities will be utilized where needed to stabilize other shoreline bank cuts unforeseen in the design. Grading will be subject to EPA approval.

6.2 ATOFINA SALT PADS

The ATOFINA salt pads were originally constructed to provide on-site salt storage for the ATOFINA facility, but are no longer in service and are available to the remedial action. The salt pads may be used during the 2003 cleanup for temporary storage and dewatering of excavated material. The salt pads will provide contingency storage of excavated material as a back up to normal direct delivery of material to waiting containers. The two asphalt-concrete paved basins have a combined capacity of approximately 15,000 cy of material. That capacity may be used for temporary storage of excavated material to accommodate unforeseen events during the remedial action or improve material handling.

Prior to use, the salt pads will be cleaned of debris and the old liners removed. The asphalt paving will be visually inspected and all cracks sealed with appropriate materials. The drains in the bottom of the pads will be closed.

Excavated material would be transferred to the salt pads by dump trucks filled at excavation sites. The material would be removed from the salt pads by front end loader placing material directly into trucks, or onto containers staged on adjacent railcars. Excess water generated at the salt pads would be collected and handled as return water to Hylebos Waterway in accordance with the project water quality monitoring plan (Appendix F).

Tables

Tables
2003 RA Work Plan

Table 1-1. Sediment Quality Objectives.

Chemical	Sediment Quality Objective[a]
METALS (mg/kg, dry weight)	
Antimony	150 [B]
Arsenic	57 [B]
Cadmium	5.1 [B]
Copper	390 [L]
Lead	450 [B]
Mercury	0.59 [L]
Nickel	140 [A, B]
Silver	6.1 [A]
Zinc	410 [B]
ORGANIC COMPOUNDS (µg/kg, dry weight)	
Low Molecular Weight Polycyclic Aromatic Hydrocarbons (LPAH)	5,200 [L]
Naphthalene	2,100 [L]
Acenaphthylene	1,300 [A, B]
Acenaphthene	500 [L]
Fluorene	540 [L]
Phenanthrene	1,500 [L]
Anthracene	960 [L]
2-Methylnaphthalene	670 [L]
High Molecular Weight PAH (HPAH)	17,000 [L]
Fluoranthene	2,500 [L]
Pyrene	3,300 [L]
Benzo(a)anthracene	1,600 [L]
Chrysene	2,800 [L]
Benzo(b+k)fluoranthenes	3,600 [L]
Benzo(a)pyrene	1,600 [L]
Indeno(1,2,3-c,d)pyrene	690 [L]
Dibenzo(a,h)anthracene	230 [L]
Benzo(g,h,i,)perylene	720 [L]
Chlorinated Organic Compounds	
1,3-Dichlorobenzene	170 [A, L, B]
1,4-Dichlorobenzene	110 [B]
1,2-Dichlorobenzene	50 [L, B]
1,2,4-Trichlorobenzene	51 [A]
Hexachlorobenzene	22 [B]
Total Polychlorinated Biphenyls (PCBs)	300*
Phthalates	
Dimethylphthalate	160 [L]
Diethylphthalate	200 [B]
Di-n-butylphthalate	1,400 [A, L]
Butylbenzylphthalate	900 [A, B]
Bis(2-Ethylhexyl)phthalate	1,300 [B]
Di-n-octylphthalate	6,200 [B]

Table 1-1. Sediment Quality Objectives.

Chemical	Sediment Quality Objective[a]
Phenols	
Phenol	420[L]
2-Methylphenol	63[A, L]
4-Methylphenol	670[L]
2,4-Dimethylphenol	29[L]
Pentachlorophenol	360[A]
Miscellaneous Extractable Compounds	
Benzyl alcohol	73[L]
Benzoic acid	650[L, B]
Dibenzofuran	540[L]
Hexachlorobutadiene	11[B]
N-Nitrosodiphenylamine	28[B]
Volatile Organic Compounds	
Tetrachloroethene	57[B]
Ethylbenzene	10[B]
Total xylenes	40[B]
Pesticides	
p, p'-DDE	9[B]
p,p'-DDD	16[B]
p,p'-DDT	34[B]
Tri-n-butyl tin (pore water µg/TBT/L)	0.7**

[a] Lowest apparent effects threshold among amphipod, oyster, and benthic infauna:

[A] amphipod mortality bioassay

[L] oyster larvae abnormality bioassay

[B] benthic infauna

*EPA's revised PCBs SQO (EPA 1997). The revised PCBs criterion is based on an assessment of potential effects of sediment PCBs on human health via consumption of seafood.

**Commencement Bay TBT Cleanup Level (Weston 1996, Hiltner 1996).

Table 2-1. Dredged Material Sampling and Analysis
Head of Hylebos Waterway

Test		STATION 1102		STATION 2105	Combined
Date Dredged		13-Dec-01		13-Dec-01	
Volume Dredged		11.5 cy		11 cy	22.5 cy
Density as dredged		1.2 tons/cy		1.1 tons/cy	1.15 tons/cy
		2369 lb/cy		2207 lb/cy	2290 lb/cy
		88 lb/cf		82 lb/cf	85 lb/cf
Decanted Water, 7 days		5 gal/cy		3.6 gal/cy	4.2 gal/cy
		41 lb/cy		30 lb/cy	35 lb/cy
		1.7% initial wt.		1.4% initial wt.	1.5% initial wt.
Visual Description		Cell A: Very soft black silty clay mixed with gray sitly sand to sandy silt (native) Cell B: Very soft black silty clay		Very soft black silty clay, with some metal debris encountered and set aside.	
Water Content					
	-day of dredging	137%		176%	
		Cell A	Cell B	Cell D	
	-2 days after dredging	71%	121%	129%	
	-5 days after dredging	77%	116%	128%	
	-7 days after dredging	64%	114%	127%	
Atterberg Limits	LL	106%		117%	
	PL	37%		37%	
	PI	69%		80%	
	USC	OH		OH	
Specific Gravity Solids		2.57		2.61	
Total Volatile Solids		8.1%		6.1%	
Consistency					
	-day of dredging	very soft		very soft	
		Cell A	Cell B	Cell D	
	-2 days after dredging	very soft	very soft	very soft	
	-5 days after dredging	very soft	very soft	very soft	
	-7 days after dredging	very soft	very soft	very soft	
Paint Filter					
	-day of dredging	pass		pass	
	-2 days after dredging	pass		pass	
TCLP Metals		< 0.5 mg/L each metal - pass		< 0.5 mg/L each metal - pass	
Dredging Elutirate Test		No WQC exceedences		No WQC exceedences	

Table 2-2. Dredge Elutriate Test Water Results (all units in µg/L).

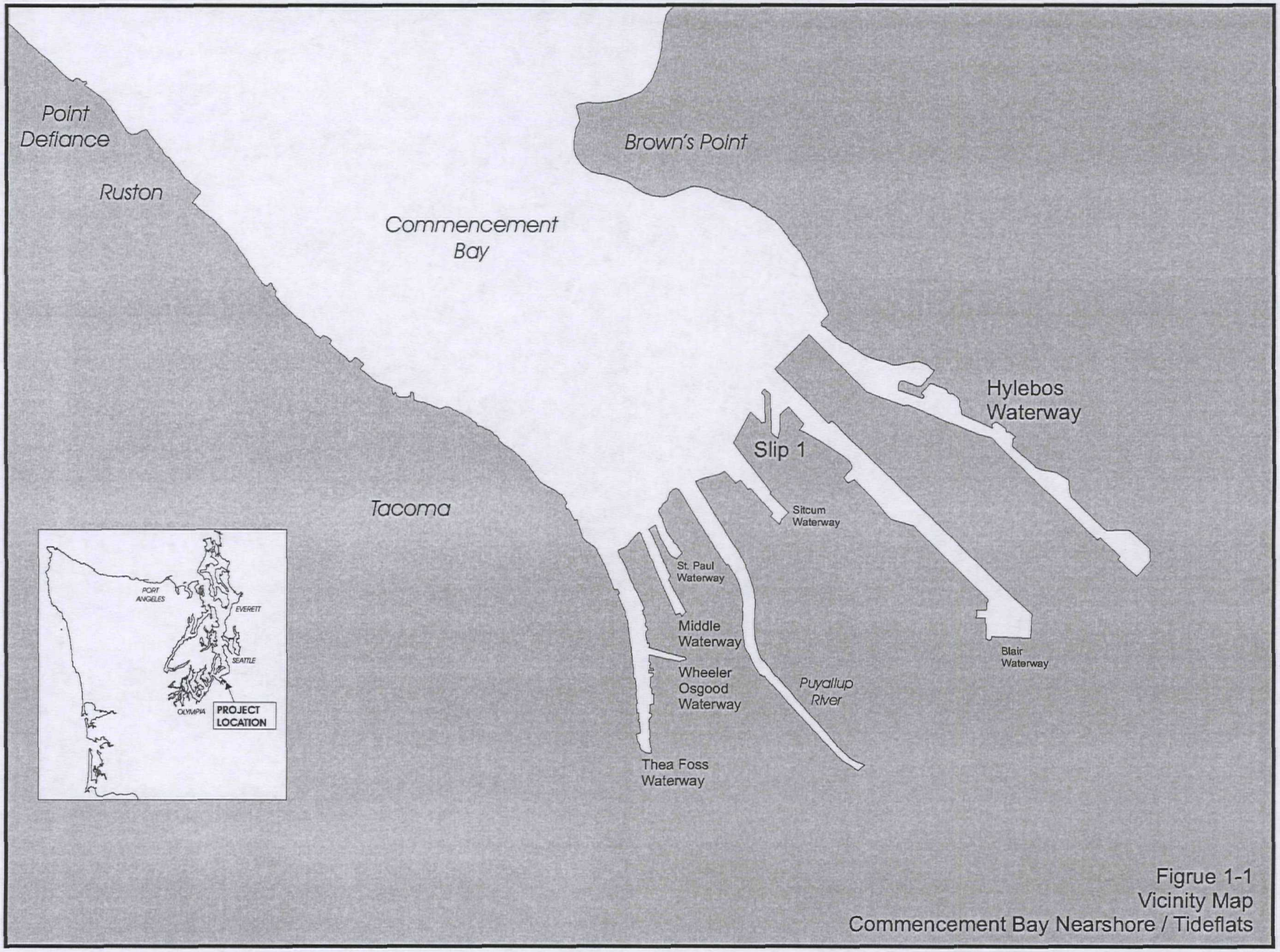
Parameter	Analytical Method	DRET 1102-DM	DRET 2105-DM	System/Source H_2O Blank	Method Blank	Threshold
arsenic (soluble)	M.7060	**2**	**2**	**2**	1 U	65.6
mercury (soluble)	M.7470	0.1 U	0.1 U	0.1 U	0.1 U	1.8
ethylbenzene	M.8260	1.0 U	1.0 U	1.0 U	1.0 U	430
4,4'-DDE	M.8081	0.05 U	0.05 U	0.05 U	0.05 U	14
4,4'-DDT	M.8081	0.05 U	0.05 U	0.05 U	0.05 U	0.13
hexachlorobutadiene	M.8081	0.025 U	0.025 U	0.025 U	0.025 U	32
total PCBs (as Aroclors)		1 U	1 U	1 U	1 U	10
fluoranthene	M.8270	**4.4**	**2.8**	0.10 U	0.10 U	40
total PAH		**8.9**	**7.2**	0.10 U	0.10 U	300

1. total PCBs = summation of detected concentrations of Aroclors 1016, 1242, 1248, 1254, 1260, 1221, and 1232, or the single highest detection limit if no Aroclors are detected.
2. total PAH = summation of detected concentrations of fluorene, phenanthrene, anthracene, fluoranthene, pyrene, benzo(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, indeno(1,2,3-cd)pyrene, dibenzo(a,h)anthracene, and benzo(g,h,i)perylene, or the single highest detection limit if no PAHs are detected.

Results from the analyses of DRET test waters show there were no exceedances of threshold marine water quality criteria in the test.

Figures

Figures
2003 RA Work Plan



Figrue 1-1
Vicinity Map
Commencement Bay Nearshore / Tideflats

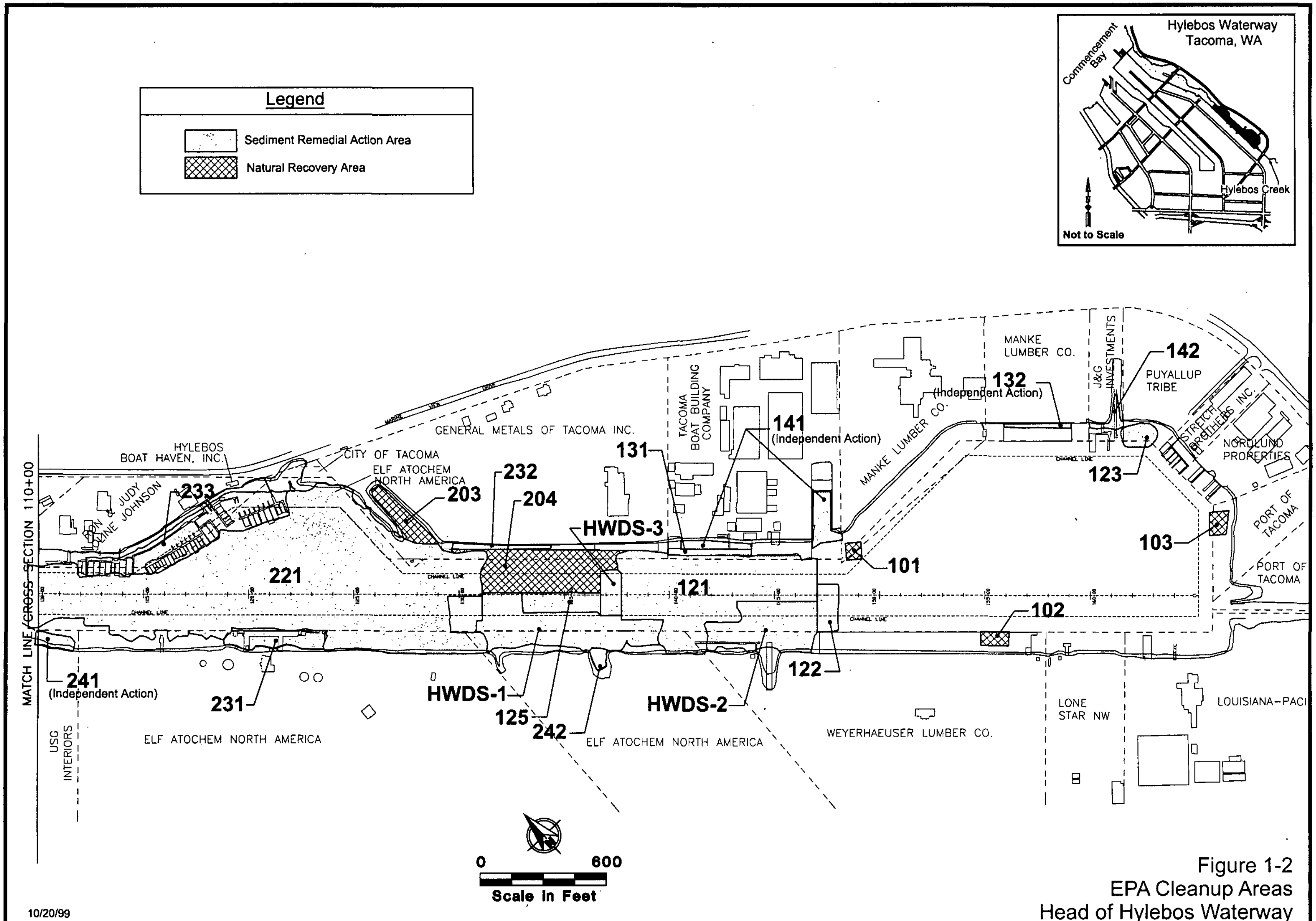


Figure 1-2
EPA Cleanup Areas
Head of Hylebos Waterway
EPA's ESD, August 2000

Dalton, Olmsted & Fuglevand, Inc.	July 2002	Hylebos

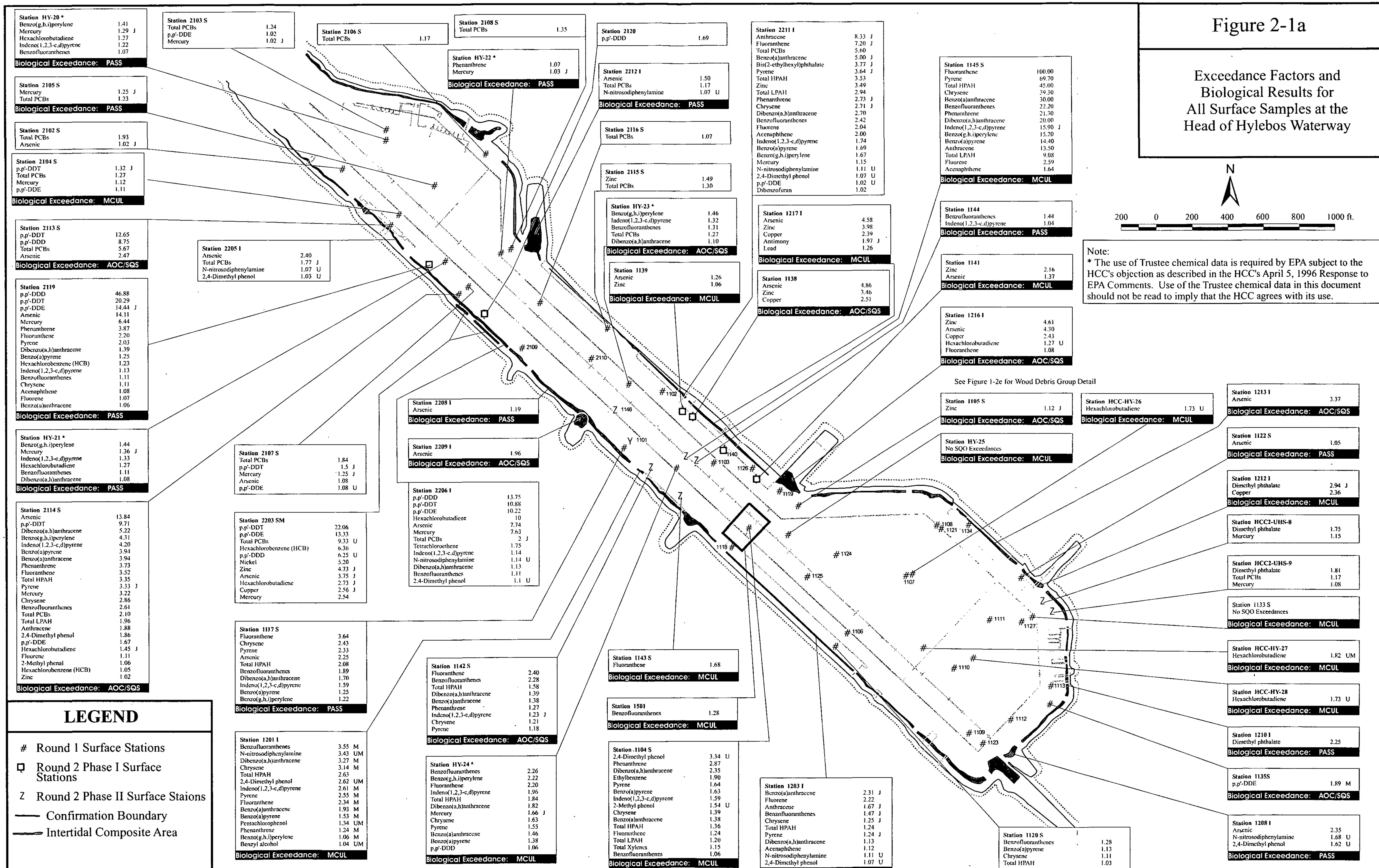


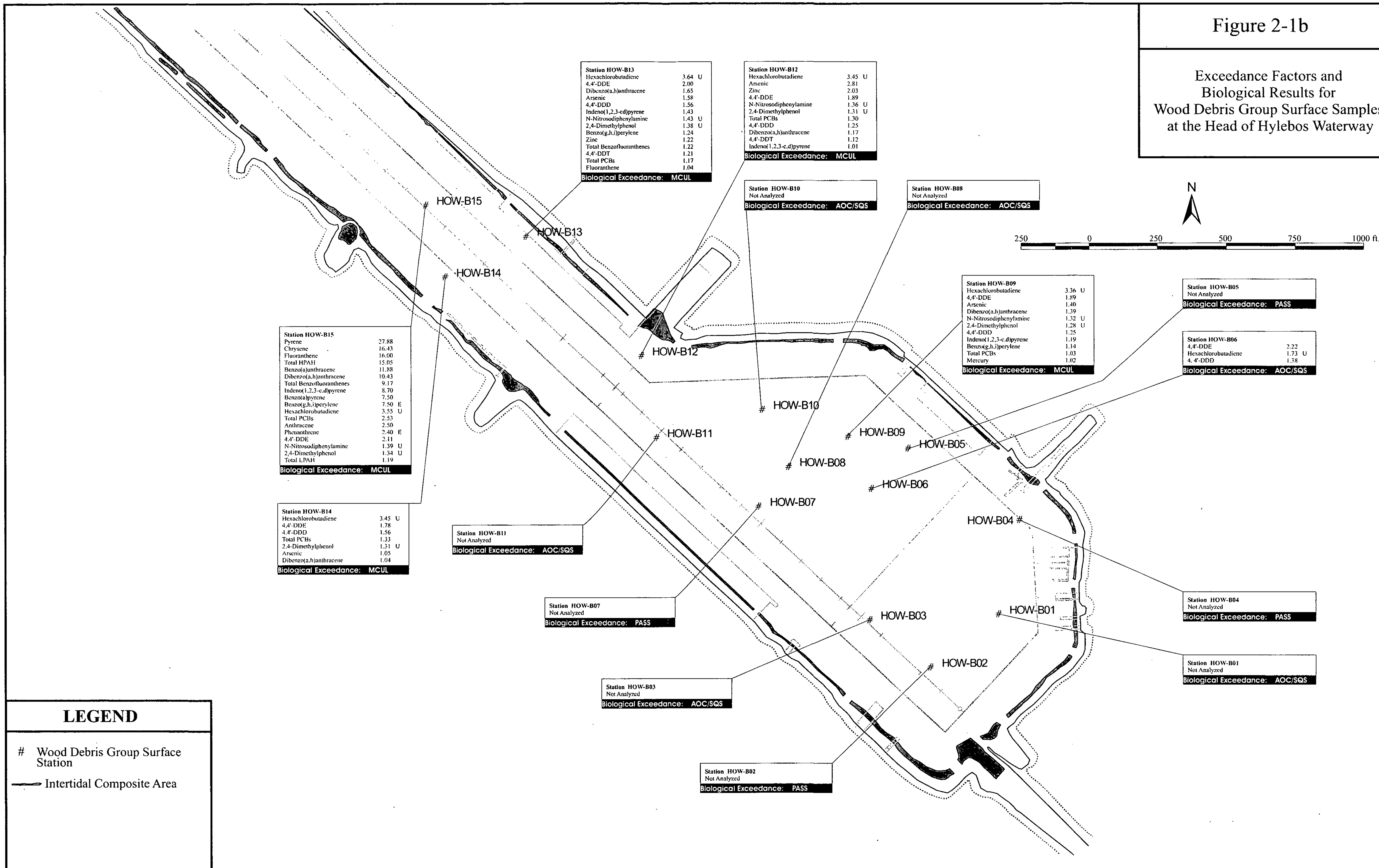
Figure 2-1a

Exceedance Factors and Biological Results for All Surface Samples at the Head of Hylebos Waterway

Note:
* The use of Trustee chemical data is required by EPA subject to the HCC's objection as described in the HCC's April 5, 1996 Response to EPA Comments. Use of the Trustee chemical data in this document should not be read to imply that the HCC agrees with its use.

Figure 2-1b

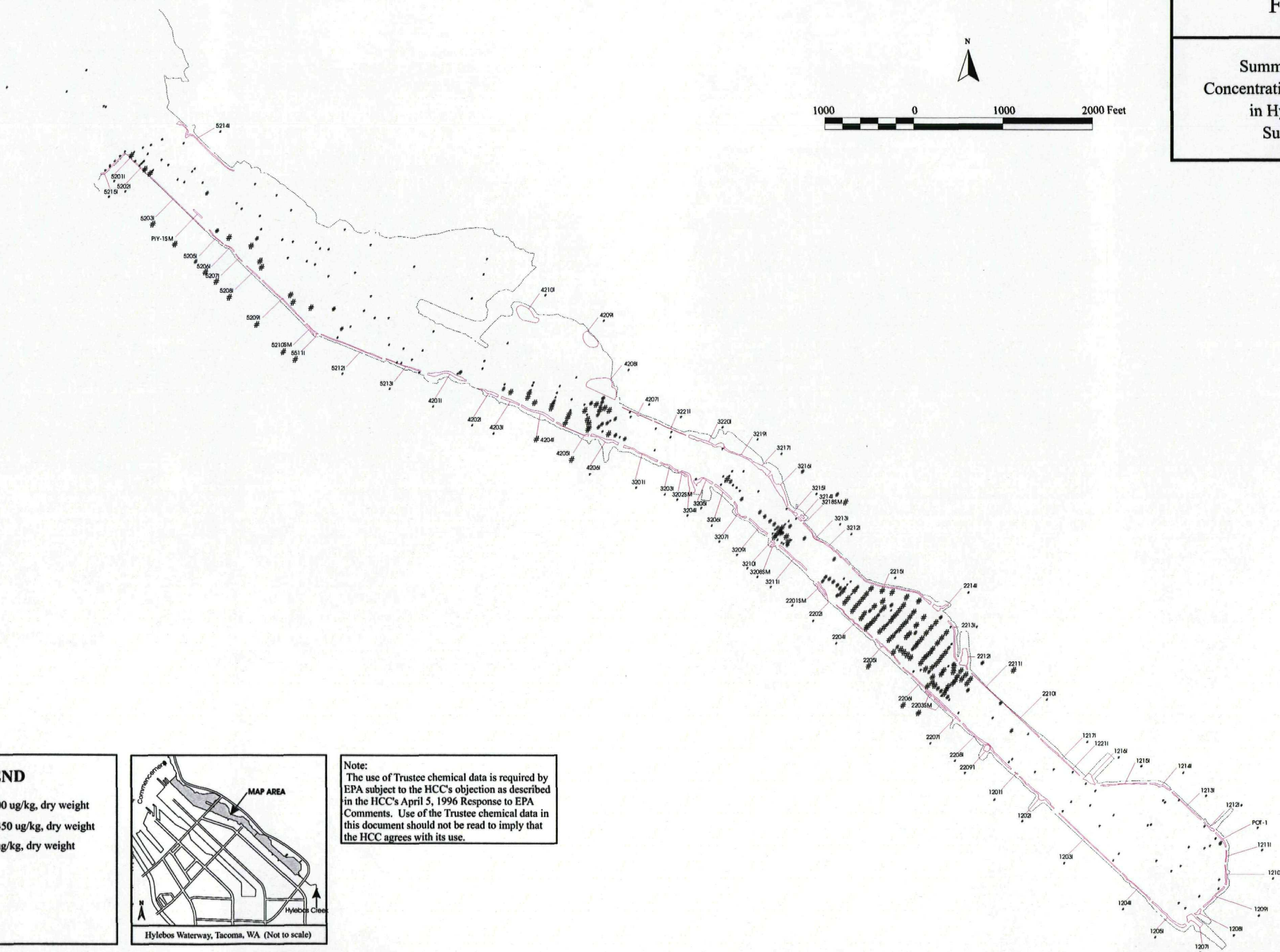
Exceedance Factors and Biological Results for Wood Debris Group Surface Samples at the Head of Hylebos Waterway



Hylebos Waterway Pre-Remedial Design Evaluation Report	November 1999	PRDE Figure 1-2e.cdr

Figure 2-2

Summary of Total PCBs Concentrations (ug/kg, dry weight) in Hylebos Waterway Surface Sediment



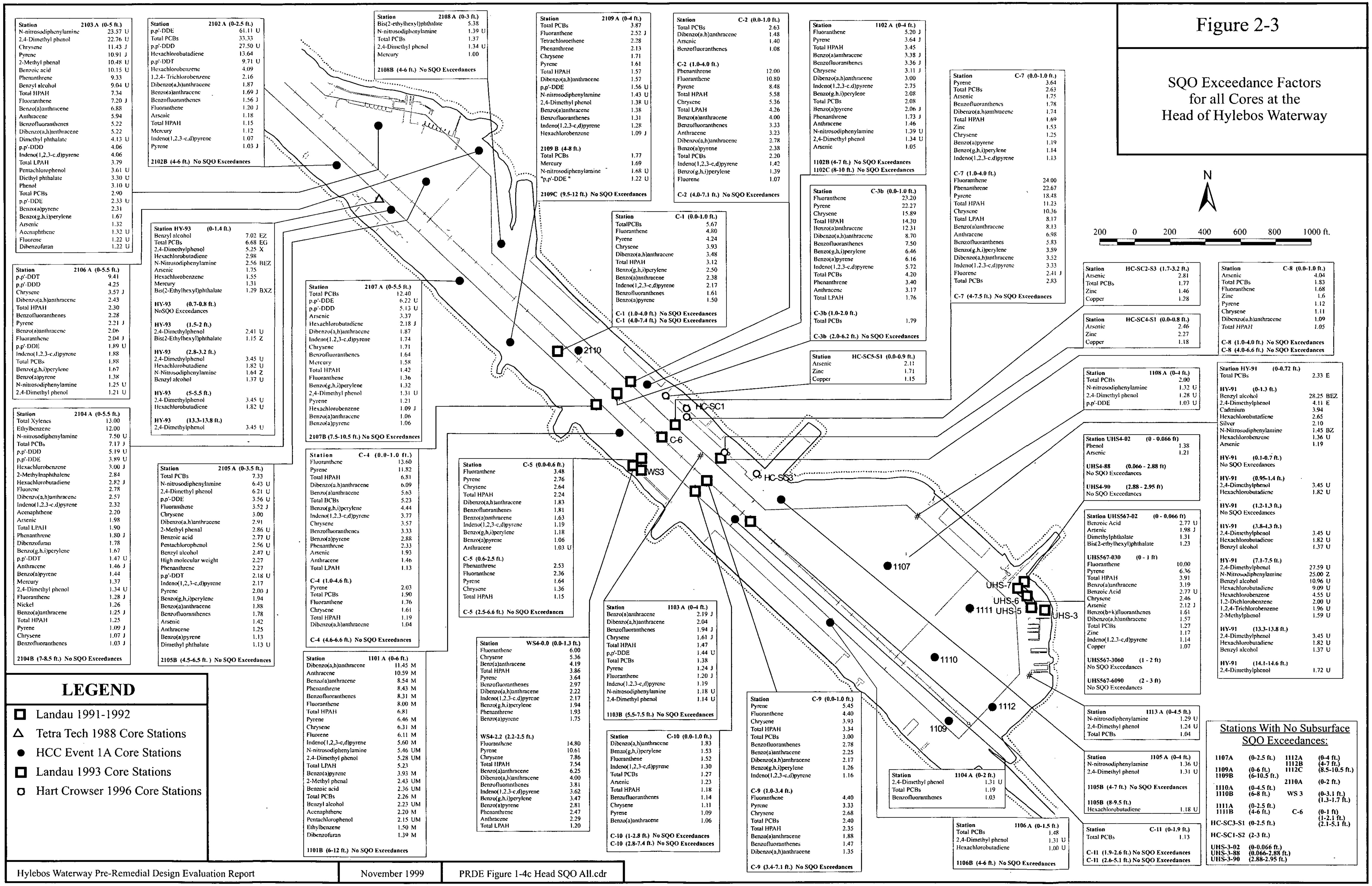


Figure 2-3
SQO Exceedance Factors for all Cores at the Head of Hylebos Waterway
N
200 0 200 400 600 800 1000 ft.
LEGEND
Landau 1991-1992
Tetra Tech 1988 Core Stations
HCC Event 1A Core Stations
Landau 1993 Core Stations
Hart Crowser 1996 Core Stations
2110
HC-SC1
C-6
WS3
HC-SC3
1107
UHS-7
UHS-6
1111 UHS-5
UHS-3
1110
1112
1109
Stations With No Subsurface SQO Exceedances:
Hylebos Waterway Pre-Remedial Design Evaluation Report
November 1999
PRDE Figure 1-4c Head SQO All.cdr

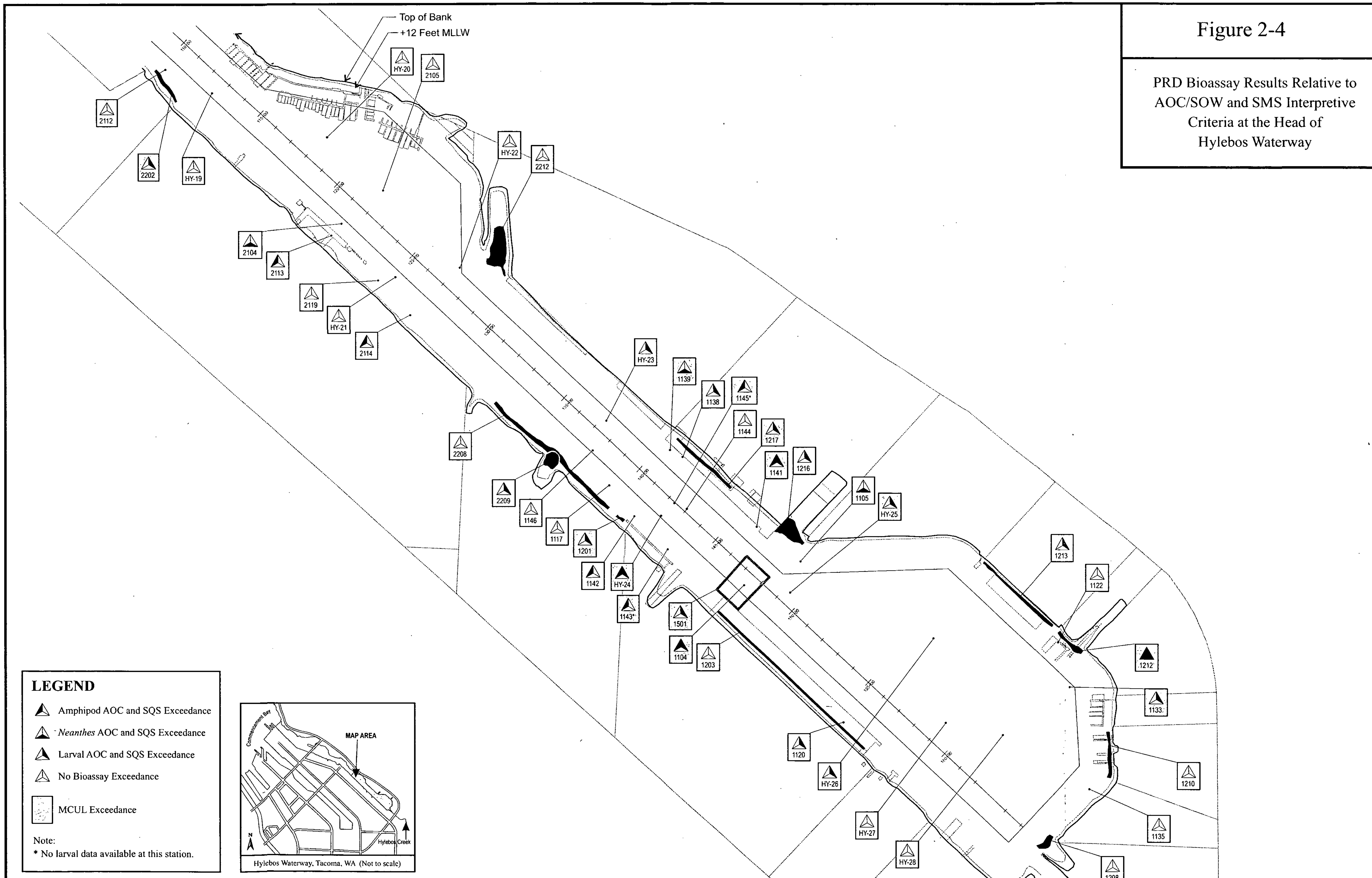
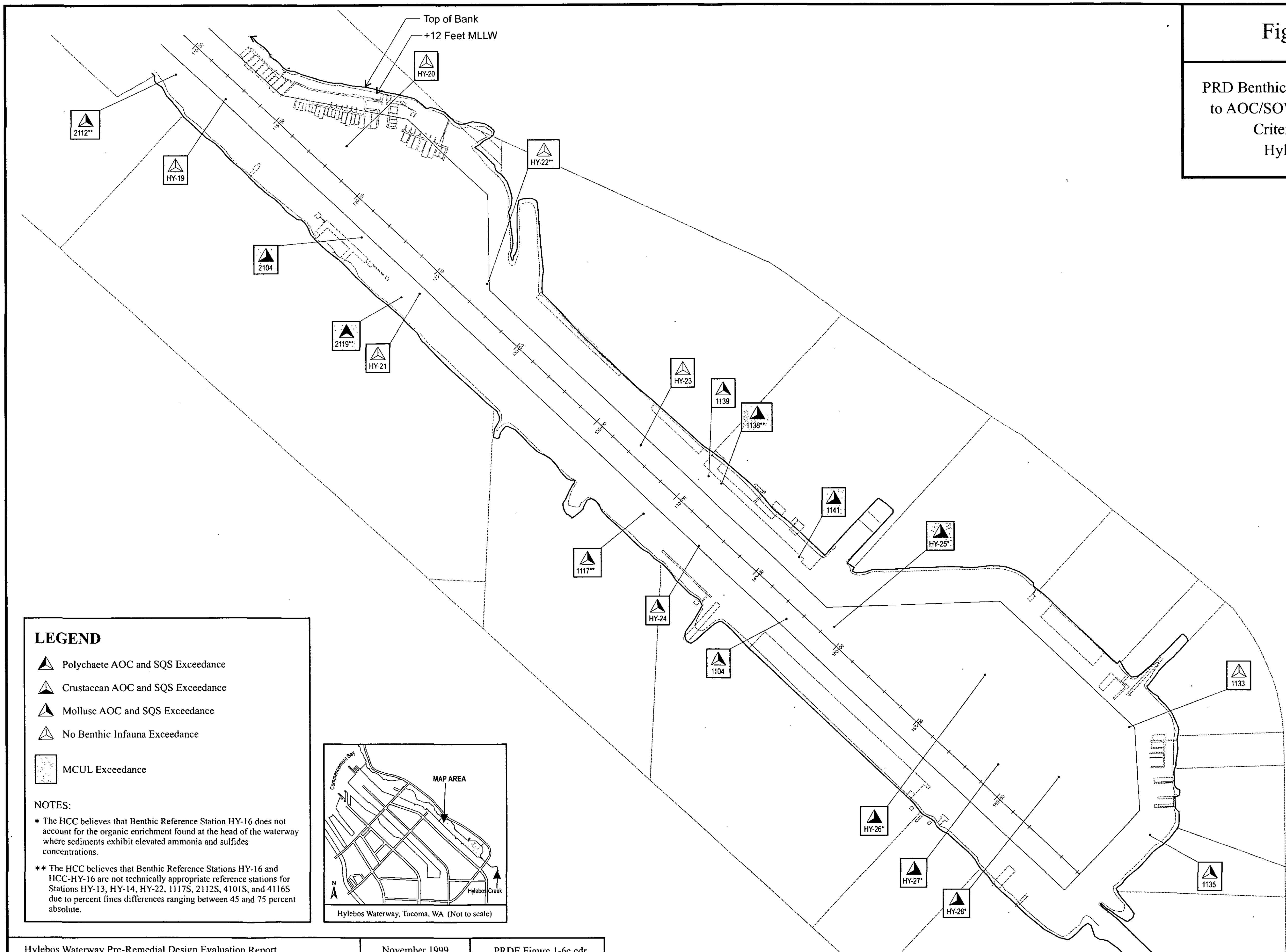


Figure 2-4

PRD Bioassay Results Relative to AOC/SOW and SMS Interpretive Criteria at the Head of Hylebos Waterway

Figure 2-5

PRD Benthic Infauna Results Relative to AOC/SOW and SMS Interpretive Criteria at the Head of Hylebos Waterway



LEGEND

- Polychaete AOC and SQS Exceedance
- Crustacean AOC and SQS Exceedance
- Mollusc AOC and SQS Exceedance
- No Benthic Infauna Exceedance
- MCUL Exceedance

NOTES:

* The HCC believes that Benthic Reference Station HY-16 does not account for the organic enrichment found at the head of the waterway where sediments exhibit elevated ammonia and sulfides concentrations.

** The HCC believes that Benthic Reference Stations HY-16 and HCC-HY-16 are not technically appropriate reference stations for Stations HY-13, HY-14, HY-22, 1117S, 2112S, 4101S, and 4116S due to percent fines differences ranging between 45 and 75 percent absolute.

Hylebos Waterway, Tacoma, WA (Not to scale)

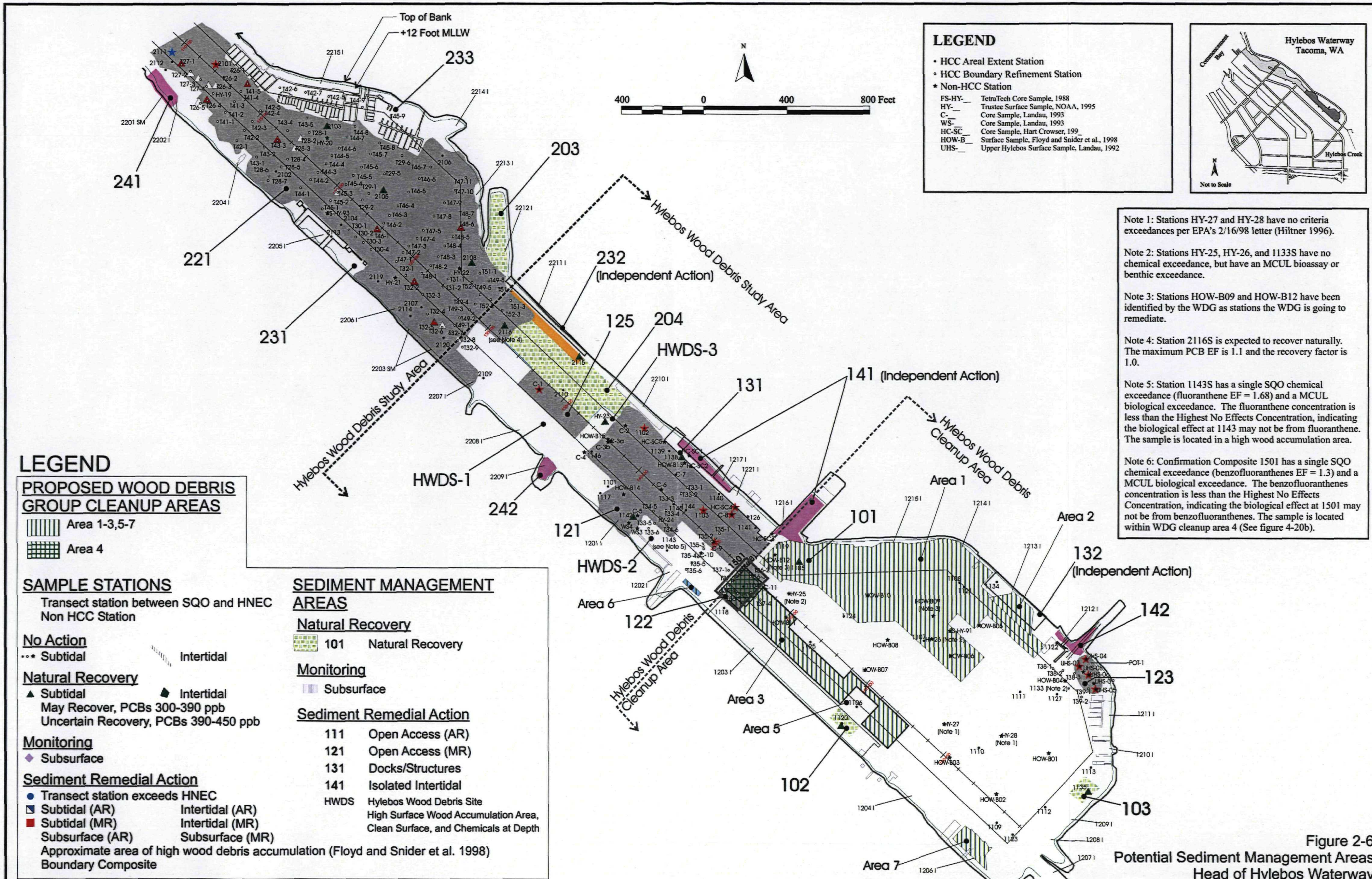
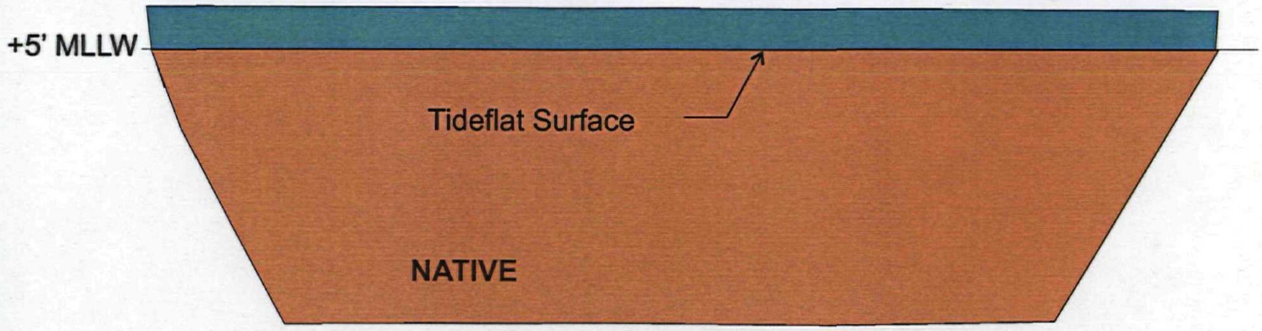
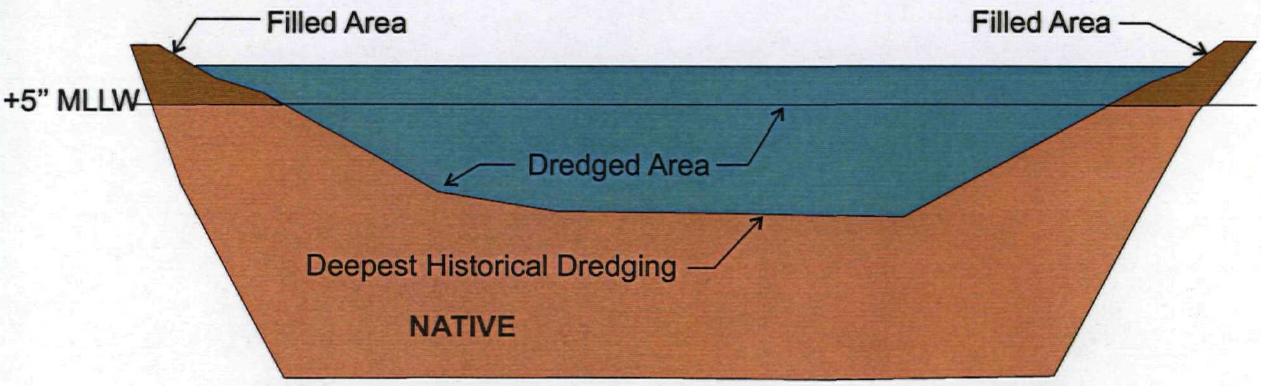


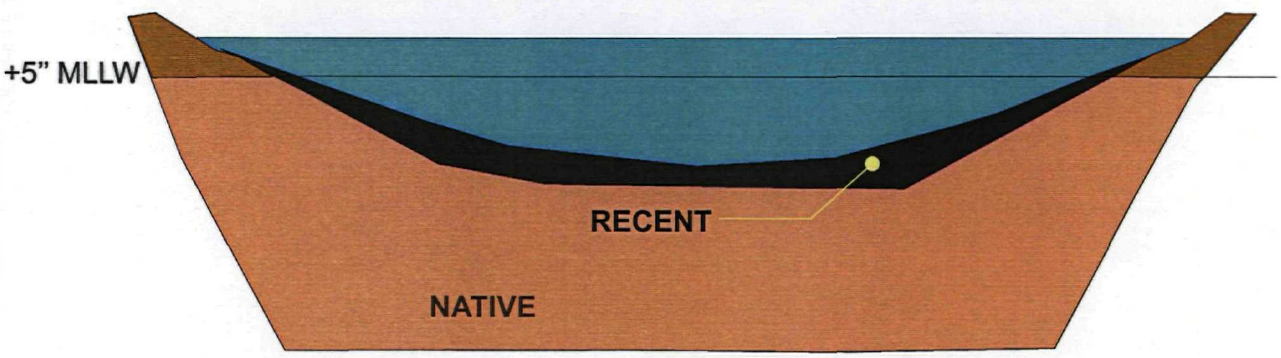
Figure 2-6
Potential Sediment Management Areas
Head of Hylebos Waterway
Hylebos Pre-Remedial Design



A. Original tideflat of native sediment



B. Baseline configuration after dredging and filling



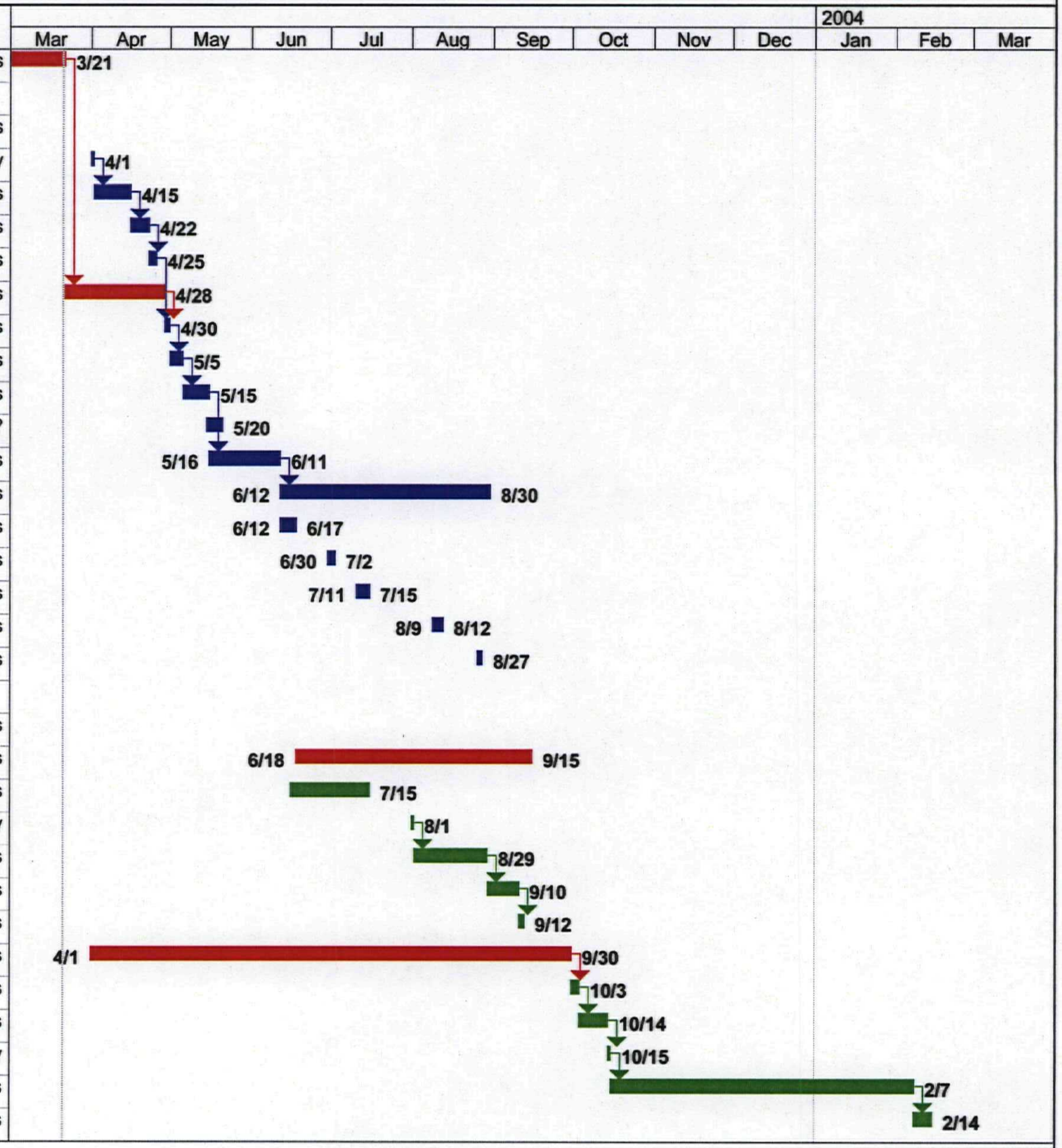
C. Existing condition with recent infilling

Figure 2-7
Waterway Construction
Head of Hylebos Waterway

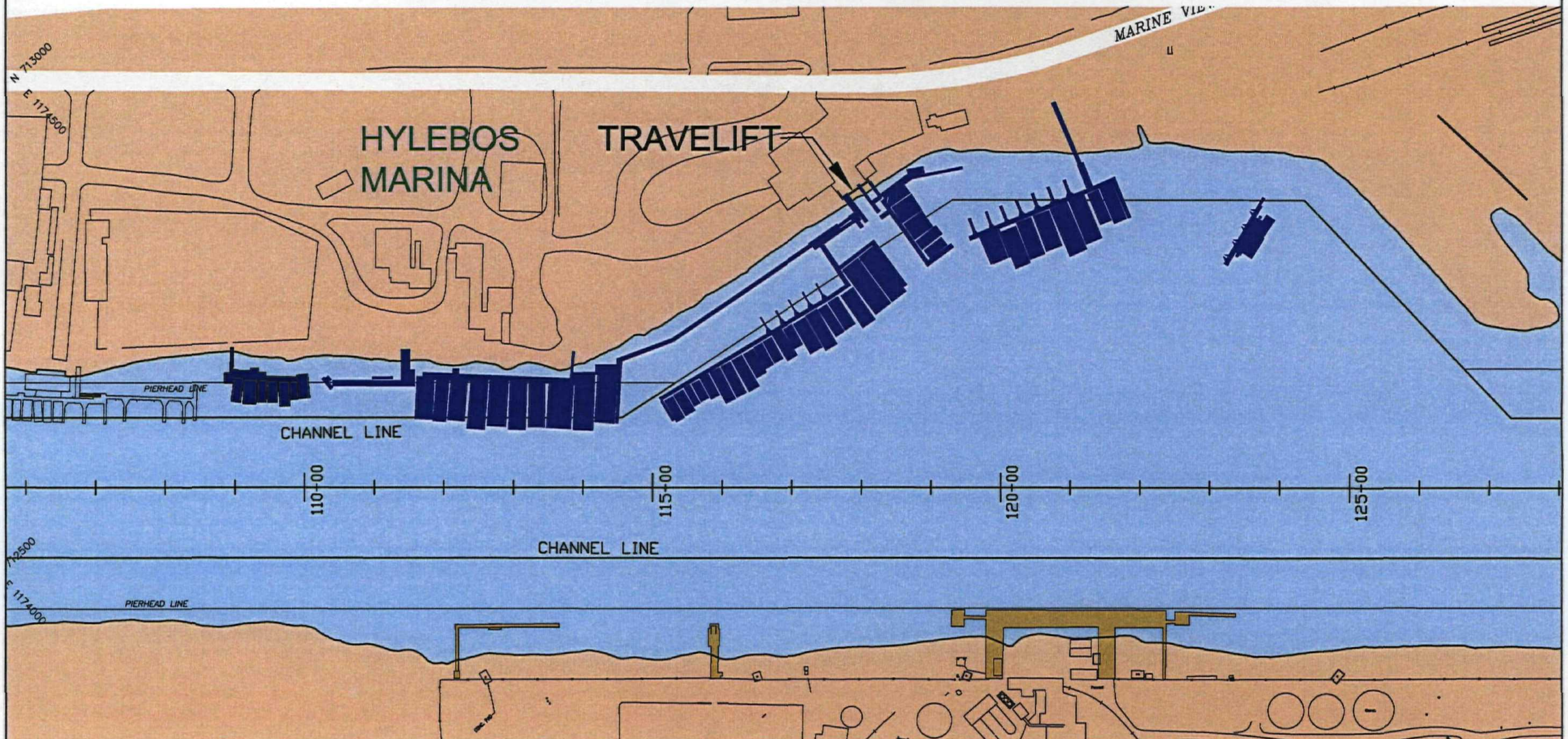
Dalton, Olmsted & Fuglevand, Inc. | November 2002 | Hylebos

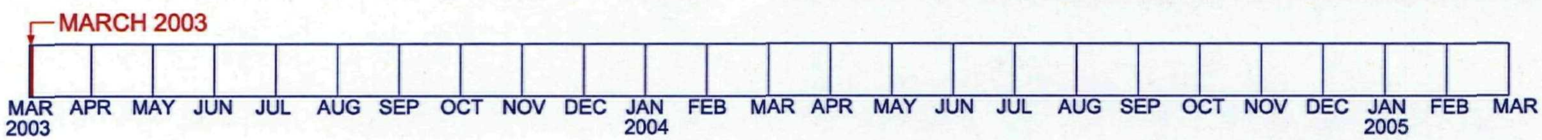
Figure 5-1. Schedule for 20[illegible] Shoreline and Marine Work
2003 RA Work Plan
Head of Hylebos Waterway
Dalton, Olmsted & Fuglevand, Inc.
Fri 3/21/03

ID	Task Name	Duration
1	HHCG Submit 2003 RA Work Plan	21 days
2		
3	SHORELINE CONSTRUCTION	0 days
4	HHCG Issue Shoreline Conrtactor RFP	1 day
5	HHCG Receive Shoreline Contractor Proposals	14 days
6	HHCG Interview Shoreline Contractors	7 days
7	HHCG Shoreline Contractor Selection	3 days
8	EPA Approve 2003 RA Work Plan	38 days
9	HHCG Award Shoreline Contract	2 days
10	Shoreline Pre Construction Meeting	5 days
11	Mobilize & Initiate Shoreline Construction	10 days
12	HHCG Shoreline Characterization Sampling	6 days?
13	Initial Bank Cleanup to El. +12' MLLW	27 days
14	Intertidal and Bank Cleanup	80 days
15	North Intertidal cleanp -Very Low Tides	6 days
16	North TZGM - Very Low Tides	3 days
17	South Intertidal cleanup - Very Low Tides	5 days
18	South TZGM - Very Low Tides	4 days
19	Pre-final construction inspection - Shoreline	2 days
20		
21	MARINE CONSTRUCTION	0 days
22	ESA Formal Consultation	90 days
23	HHCG ID Pre-qualified Marine Contractors	30 days
24	HHCG Issue Marine Contractor RFP	1 day
25	HHCG Receive Marine Contractor Proposals	28 days
26	HHCG Interview Marine Contractors	12 days
27	HHCG Marine Contractor Selection	2 days
28	Corps - Hylebos Marina permit issued	183 days
29	HHCG Award Marine Contract	3 days
30	Marine Pre-Construction Meeting	11 days
31	Mobilize and Initiate Marine Construction	1 day
32	Marine Construction	115 days
33	Pre-final construction inspection - Marine	7 days



HYLEBOS MARINA DREDGING OPERATIONS PLAN
RELOCATION WITHIN TURNING BASIN





HHCG00102-40b

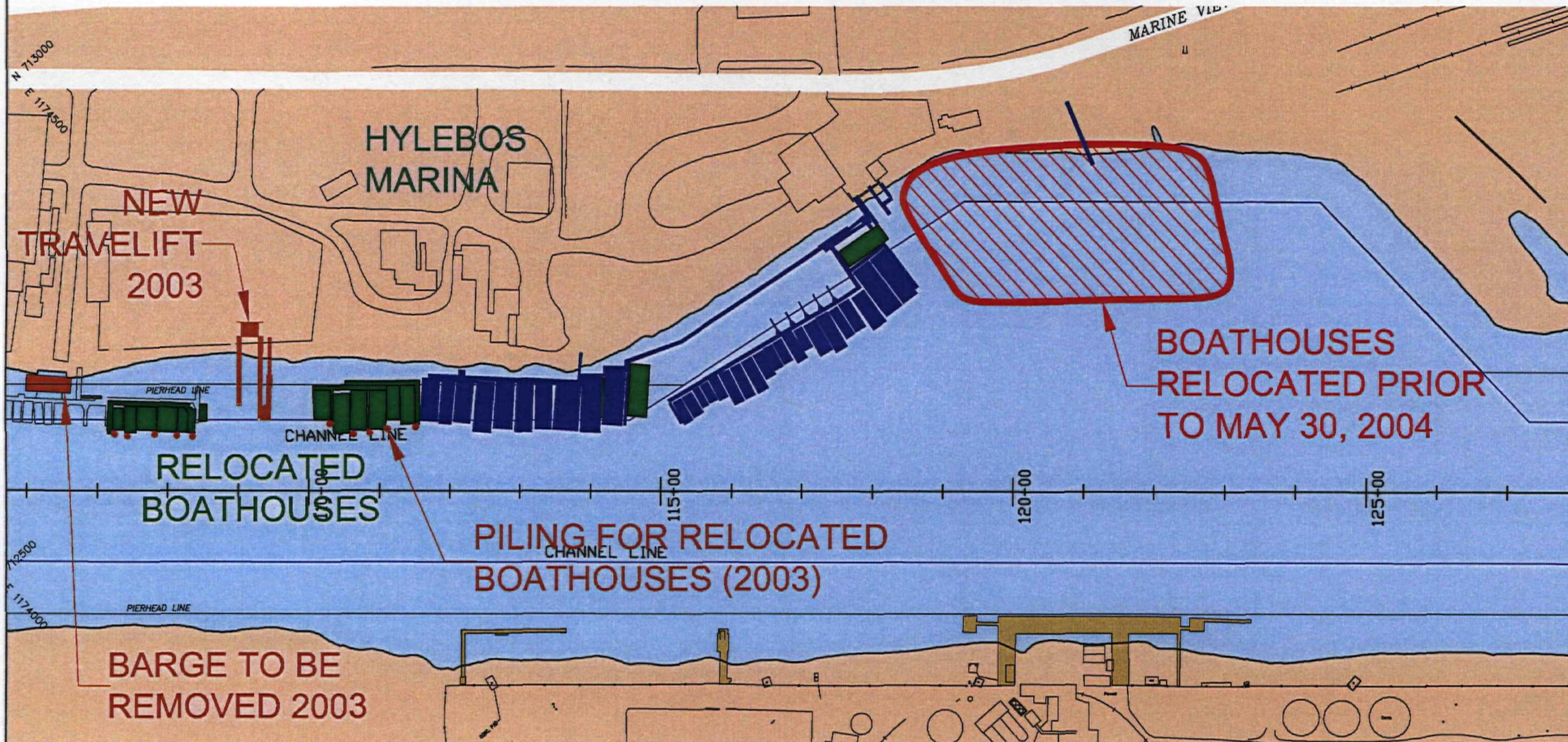
HEAD OF HYLEBOS WATERWAY

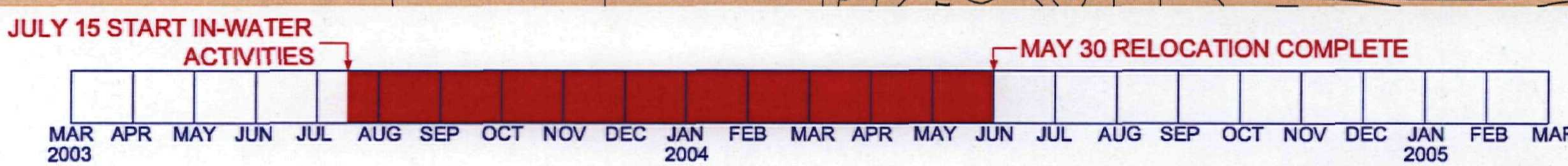
EXISTING CONDITION

HHCG00102 **FIGURE M-1** 03/13/03

Dalton, Olmsted & Fuglevand, Inc.

HYLEBOS MARINA DREDGING OPERATIONS PLAN
RELOCATION WITHIN TURNING BASIN





HEAD OF HYLEBOS WATERWAY

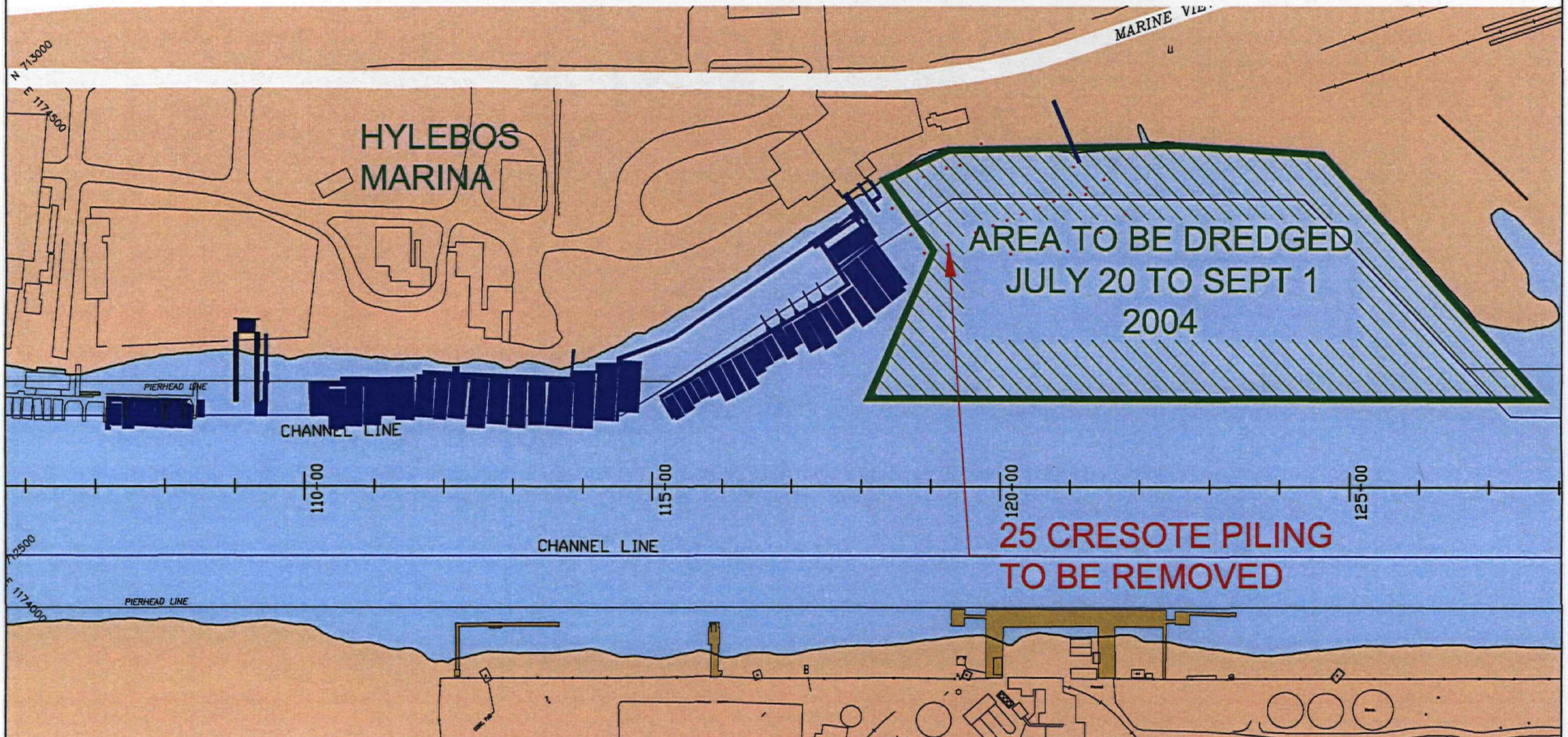
2003 THRU JUNE 2004
MARINA ACTIVITIES

HHCG00102 **FIGURE M-2** 03/13/03

Dalton, Olmsted & Fuglevand, Inc.

HHCG00102-40b

HYLEBOS MARINA DREDGING OPERATIONS PLAN
RELOCATION WITHIN TURNING BASIN



HHCG00102-40b

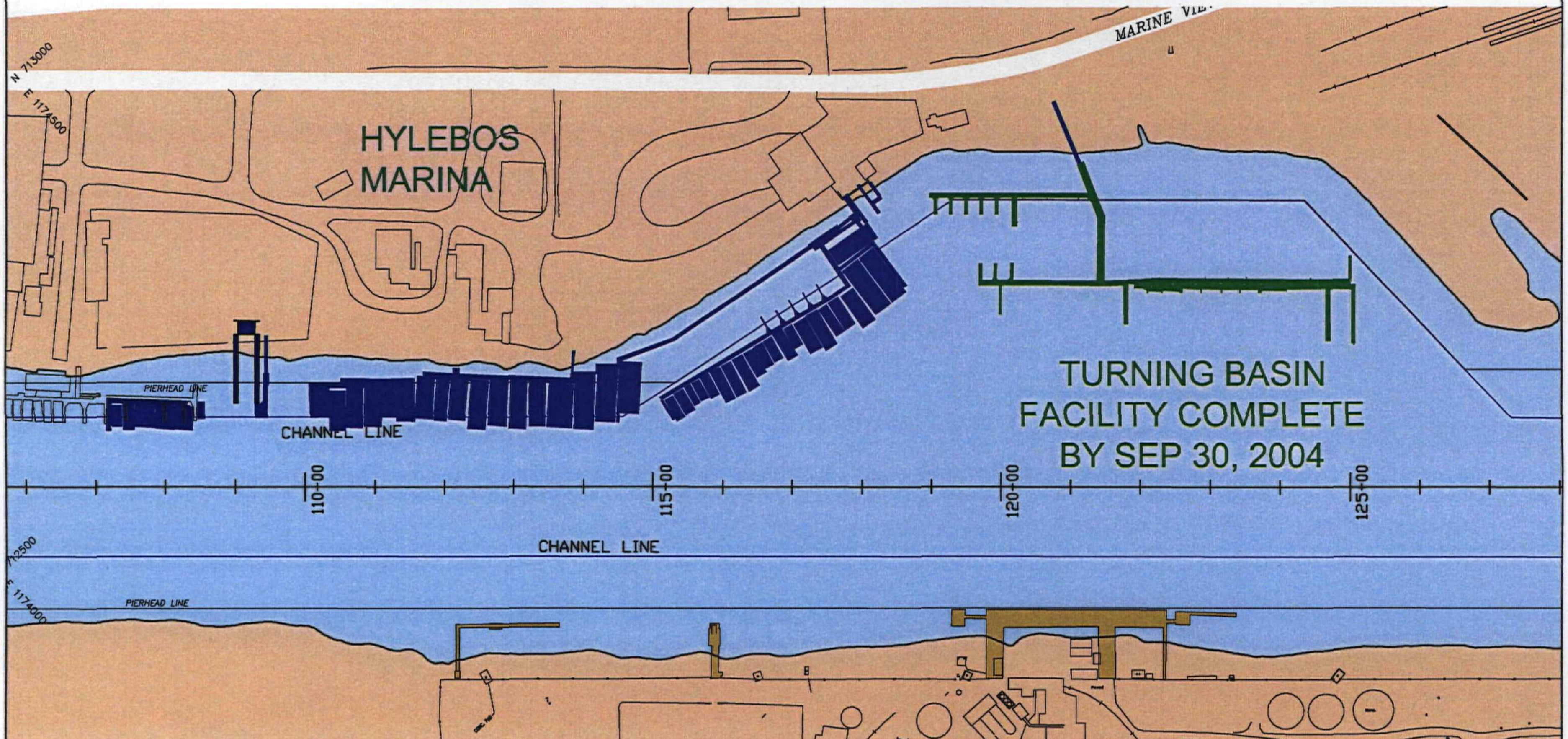
HEAD OF HYLEBOS WATERWAY

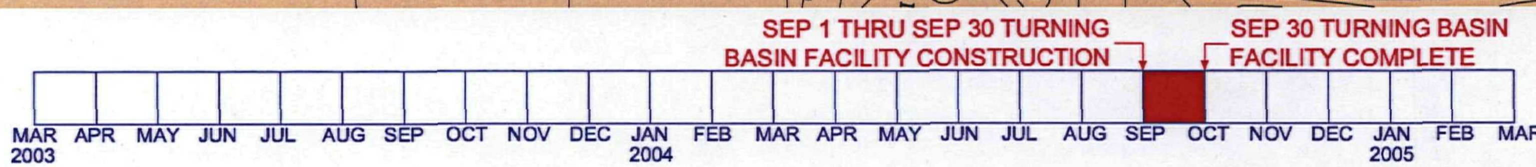
TURNING BASIN DREDGING FOR MARINA

HHCG00102 **FIGURE M-3** 03/13/03

Dalton, Olmsted & Fuglevand, Inc.

HYLEBOS MARINA DREDGING OPERATIONS PLAN
RELOCATION WITHIN TURNING BASIN





HHCG00102-40b

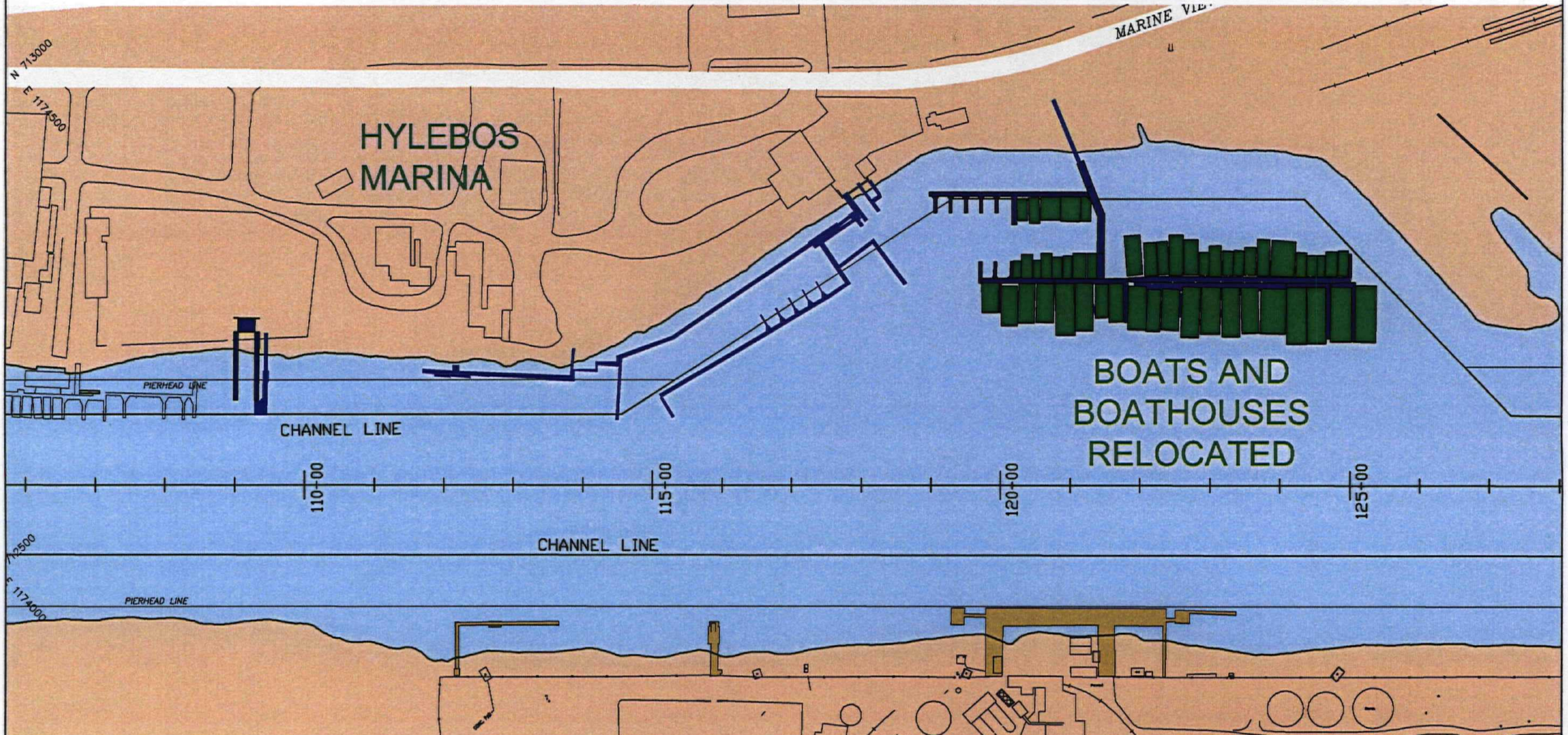
HEAD OF HYLEBOS WATERWAY

RECONFIGURED MARINA IN DREDGE AREA

HHCG00102 **FIGURE M-4** **03/13/03**

Dalton, Olmsted & Fuglevand, Inc.

HYLEBOS MARINA DREDGING OPERATIONS PLAN
RELOCATION WITHIN TURNING BASIN



HHCG00102-40b

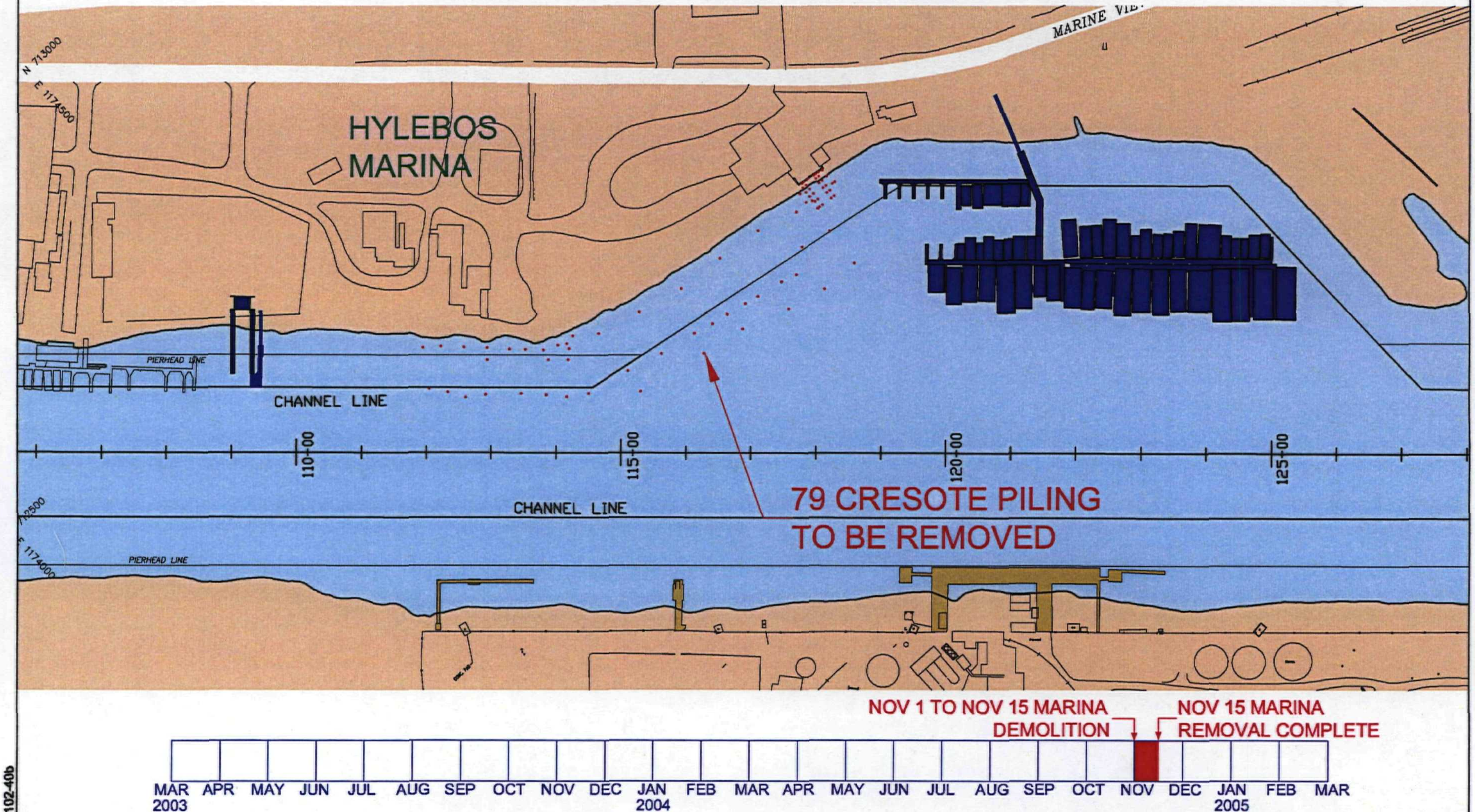
HEAD OF HYLEBOS WATERWAY

BOATS AND BOATHOUSES RELOCATED

HHCG00102 **FIGURE M-5** 03/13/03

Dalton, Olmsted & Fuglevand, Inc.

HYLEBOS MARINA DREDGING OPERATIONS PLAN
RELOCATION WITHIN TURNING BASIN



HHCG00102-40b

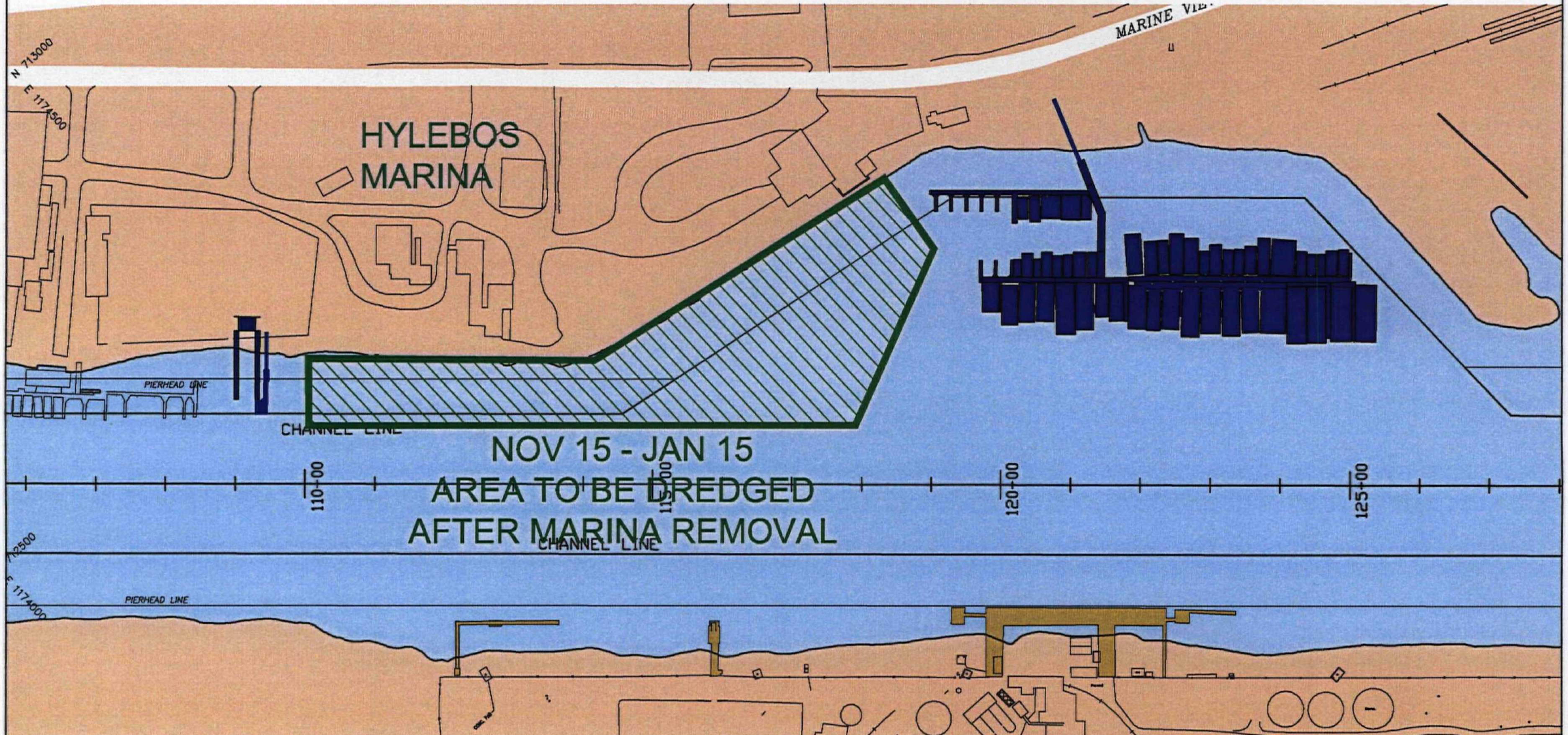
HEAD OF HYLEBOS WATERWAY

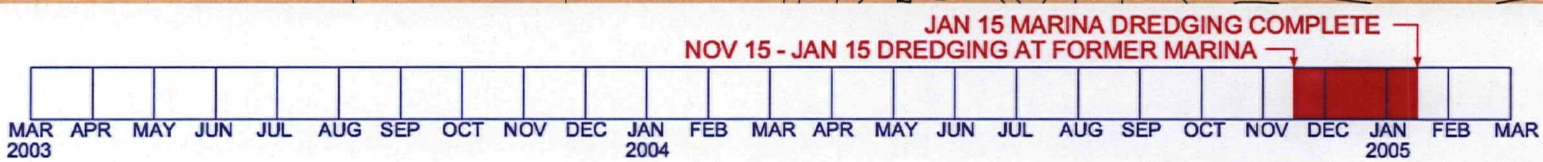
MARINA REMOVED FROM WESTERN PORTION OF SITE

HHCG00102 **FIGURE M-6** 03/13/03

Dalton, Olmsted & Fuglevand, Inc.

HYLEBOS MARINA DREDGING OPERATIONS PLAN
RELOCATION WITHIN TURNING BASIN

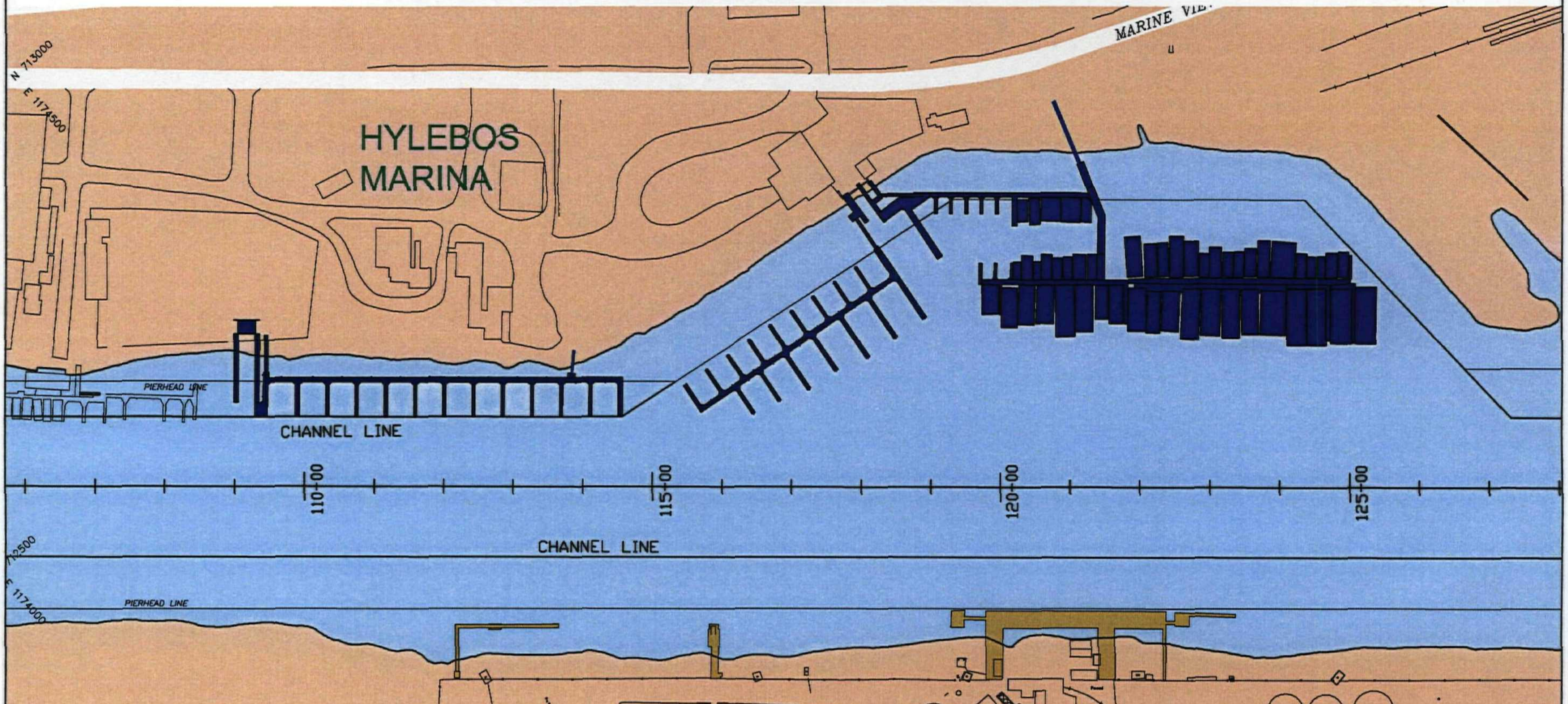


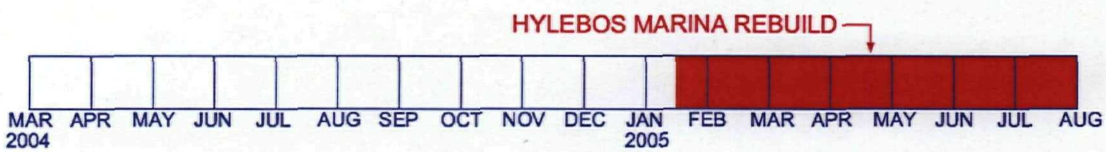


HHCG00102-40b

HEAD OF HYLEBOS WATERWAY		
DREDGING AT HYLEBOS MARINA		
HHCG00102	**FIGURE M-7**	03/13/03
Dalton, Olmsted & Fuglevand, Inc.		

HYLEBOS MARINA DREDGING OPERATIONS PLAN
RELOCATION WITHIN TURNING BASIN





HEAD OF HYLEBOS WATERWAY

MARINA REBUILD 2005

HHCG00102 **FIGURE M-8** 03/13/03

Dalton, Olmsted & Fuglevand, Inc.

HHCG00102-40b

Drawings
2003 RA Work Plan

ROBERT S. WEBB
STATE OF WASHINGTON
35713
REGISTERED PROFESSIONAL ENGINEER
5/1/03

EXPIRES: 08/29/03

GENERAL NOTES:
1. AERIAL PHOTOGRAPH TAKEN ON MAY 15, 2002 BY WALKER AND ASSOCIATES.
2. PROPERTY LINE BOUNDARIES DERIVED FROM CITY OF TACOMA PUBLIC WORKS DEPT. GIS DATA. THIS DATA IS APPROXIMATE AND MAY NOT REFLECT ACTUAL RECORDED SURVEYS.

LEGEND

- DENOTES AREAS OF MAJOR ACTIVITIES
- CONTRACTOR ACCESS REQUIRED
- LAND BASED EXCAVATION

100 0 100
Scale in Feet

DALTON, OLMSTED & FUGLEVAND, INC.
Environmental Consultants
10705 Silverdale Way NW Suite 201
Silverdale, WA 98383

THIS PLAN SET APPROVED FOR 2003 REMEDIAL ACTIONS ONLY. 2003 REMEDIAL ACTION HIGHLIGHTED ON DRAWINGS.

REVISIONS				
REV	DATE	BY	APP'D	DESCRIPTION

DESIGNED BY: R. WEBB/L. BARRAS
DRAWN BY: L. BARRAS
CHECKED BY: R. WEBB
APPROVED BY: P. FUGLEVAND
FILE: HCCG00102-35
DATE: 05/01/03

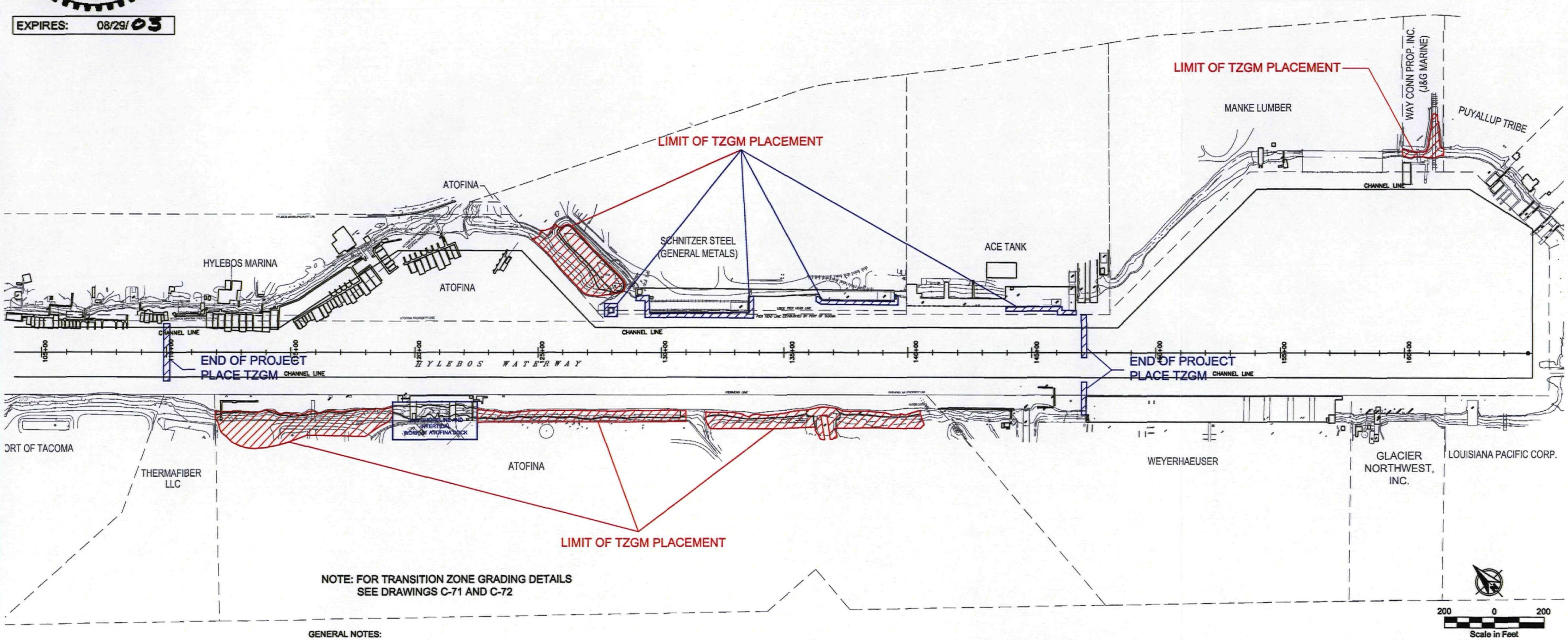
FINAL (100%) DESIGN 2003 REMEDIAL ACTION
HEAD OF HYLEBOS WATERWAY

ATOFINA UPLANDS
2003 RA SITE PLAN

DRAWING NO. AU-3
PROJECT NO. HHCG00102
SHEET NO. 90 OF 91

ROBERT S. WEBB
STATE OF WASHINGTON
35713
REGISTERED PROFESSIONAL ENGINEER
5/1/03

EXPIRES: 08/29/03



GENERAL NOTES:

1. BASE MAP FEATURES AND CONTOURS PHOTOGRAMMETRICALLY MAPPED BY WALKER AND ASSOCIATES, MAY 2002.
2. PROPERTY LINE BOUNDARIES (OTHER THAN HYLEBOS MARINA AND SCHNITZER STEEL) DERIVED FROM CITY OF TACOMA PUBLIC WORKS DEPT. GIS DATA. THIS DATA IS APPROXIMATE AND MAY NOT REFLECT ACTUAL RECORDED SURVEYS. HYLEBOS MARINA AND SCHNITZER STEEL PROPERTY LINES FROM SITTS & HILL ENGINEERING RECORD OF SURVEY A.F.N. 2002211015001, NOVEMBER 2002.

LEGEND

- TRANSITION GRADING AREA (2003)
- TRANSITION GRADING AREA (2004)

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Environmental Consultants
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Silverdale, WA 98383

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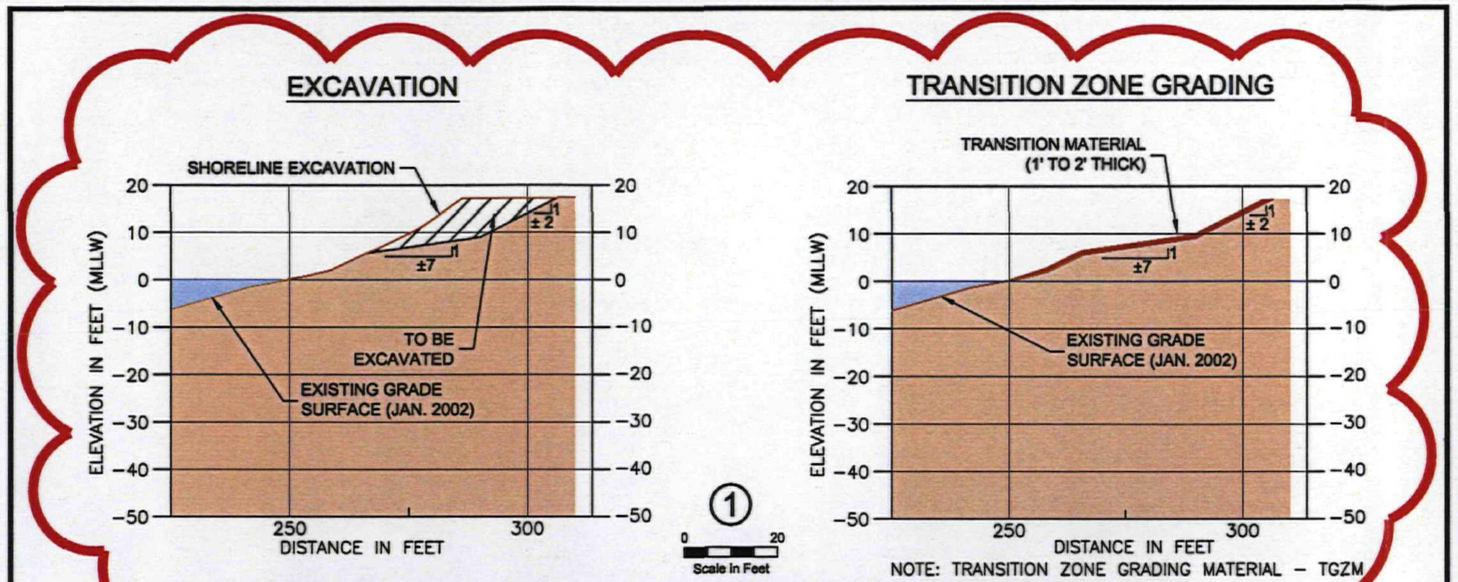
REV	DATE	BY	APP'D	DESCRIPTION

DESIGNED BY: R. WEBB/L. BARRAS
DRAWN BY: L. BARRAS/B. JOHNSTON
CHECKED BY: R. WEBB
APPROVED BY: P. FUGLEVAND
FILE: HCCG00102-36
DATE: 05/01/03

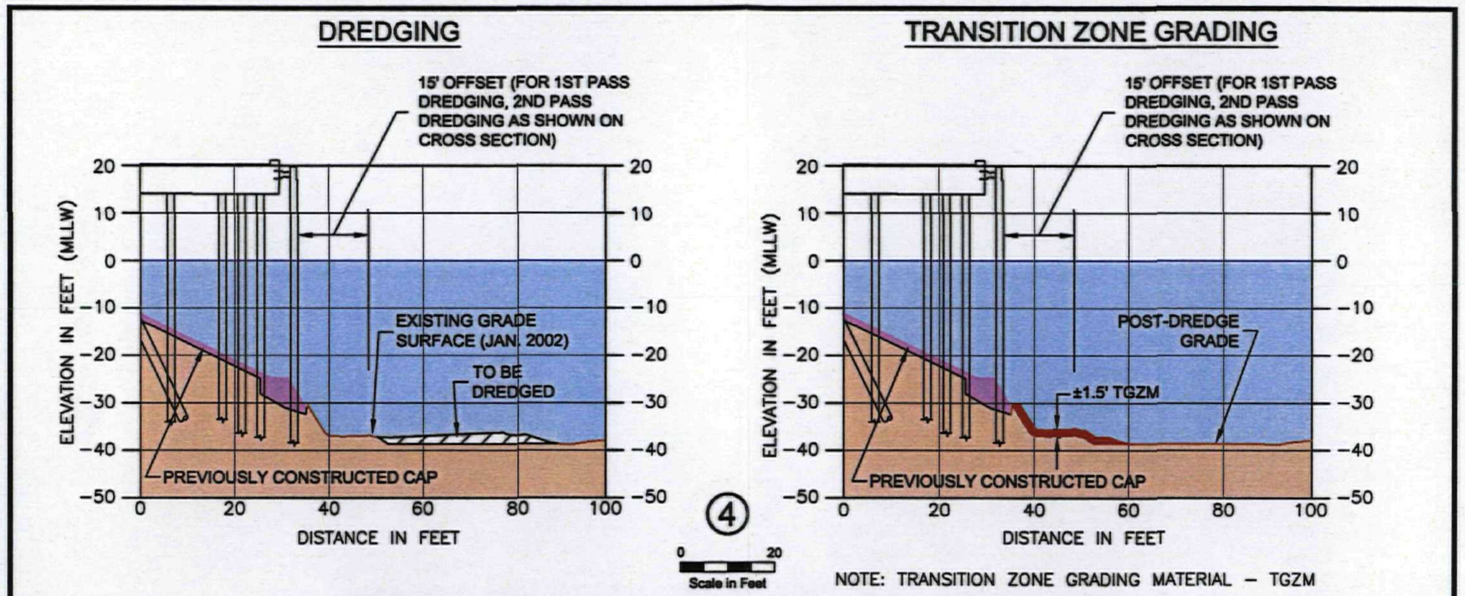
FINAL (100%) DESIGN 2003 REMEDIAL ACTION
HEAD OF HYLEBOS WATERWAY

TRANSITION ZONE GRADING
KEY MAP

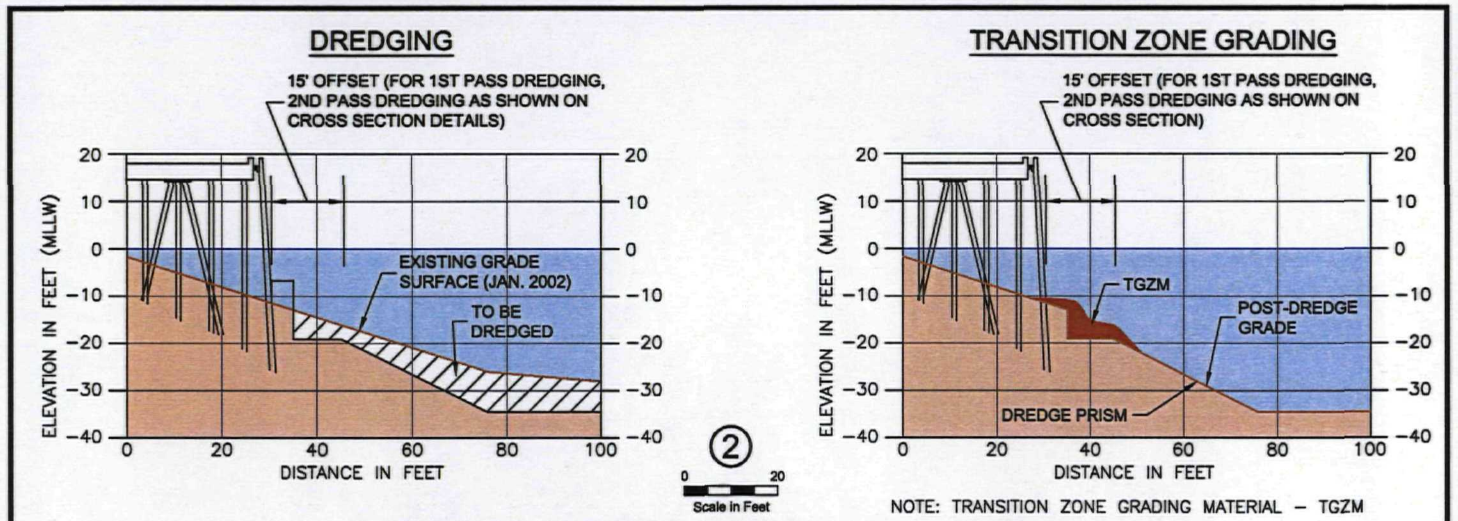
DRAWING NO. C-70
PROJECT NO. HHCG00102
SHEET NO. 72 OF 91



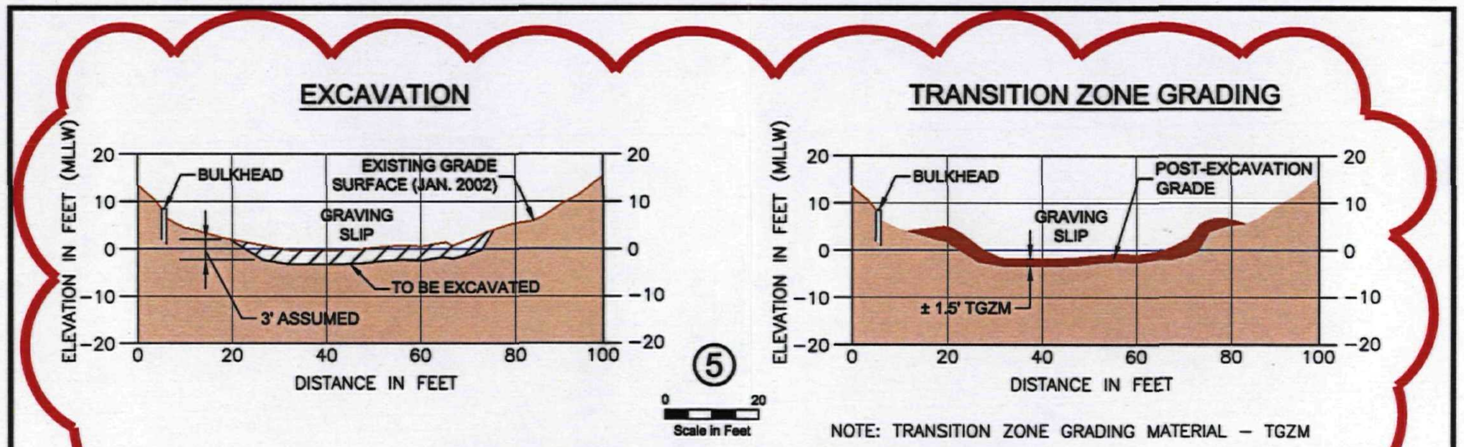
BANK CLEANUP / INTERTIDAL TRANSITION AREA DETAILS (TYP.) (2003)



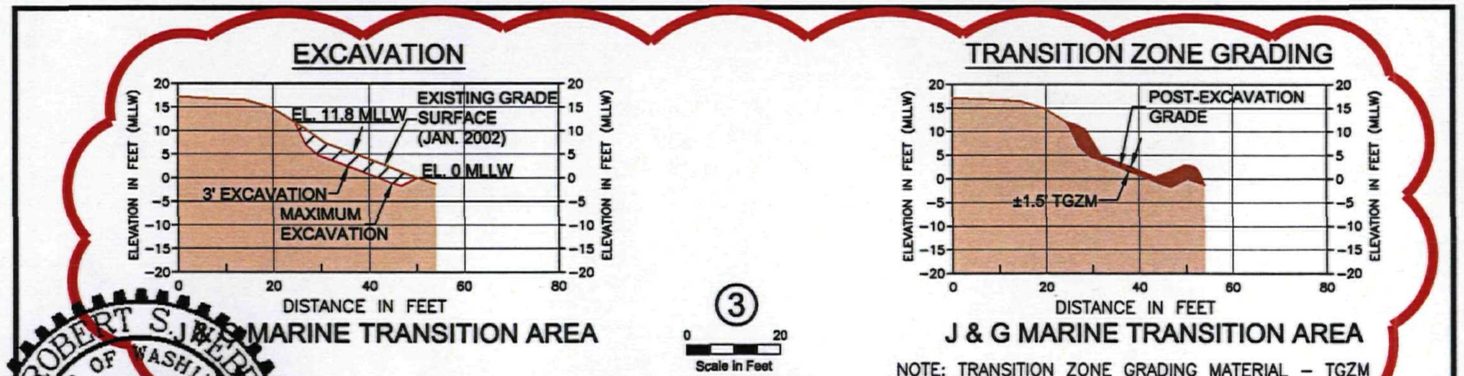
GENERAL METALS TRANSITION AREA DETAILS (TYP.) (2004)



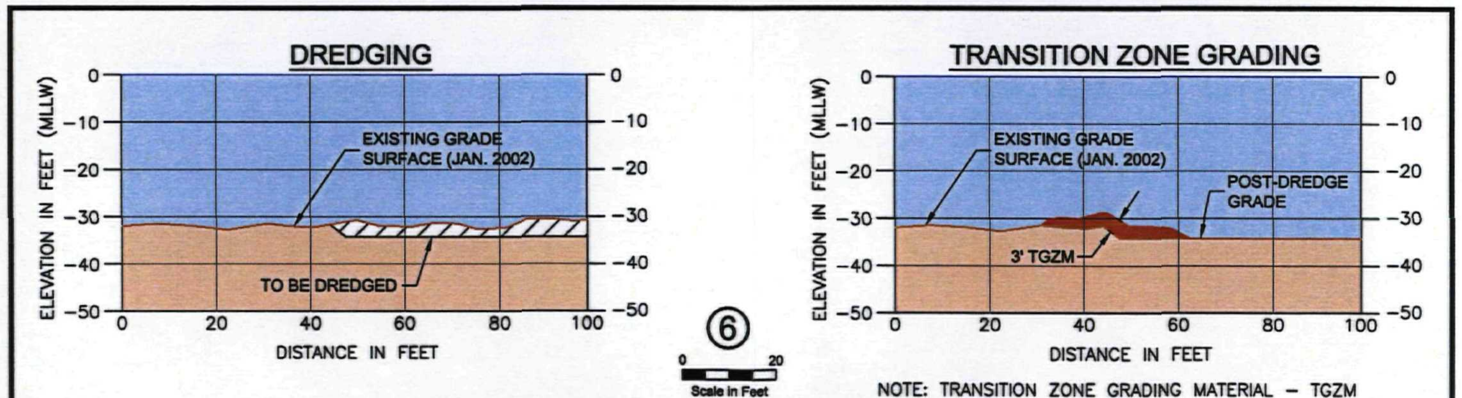
ACE TANK TRANSITION AREA DETAILS (TYP.) (2004)



GENERAL METALS GRAVING SLIP EXCAVATION
TRANSITION AREA DETAILS (TYP.) (2003)



J & G TRANSITION AREA DETAILS (TYP.) (2003)



END TRANSITION AREA DETAILS (TYP.) (2004)

ROBERT S. WEBB
STATE OF WASHINGTON
REGISTERED PROFESSIONAL ENGINEER
35713
5/1/03

DALTON, OLMSTED & FUGLEVAND, INC.
Environmental Consultants
10705 Silverdale Way NW Suite 201
Silverdale, WA 98383

EXPIRES: 08/29/03

THIS PLAN SET APPROVED FOR 2003 REMEDIAL ACTIONS ONLY. 2003 REMEDIAL ACTION HIGHLIGHTED ON DRAWINGS.

REVISIONS

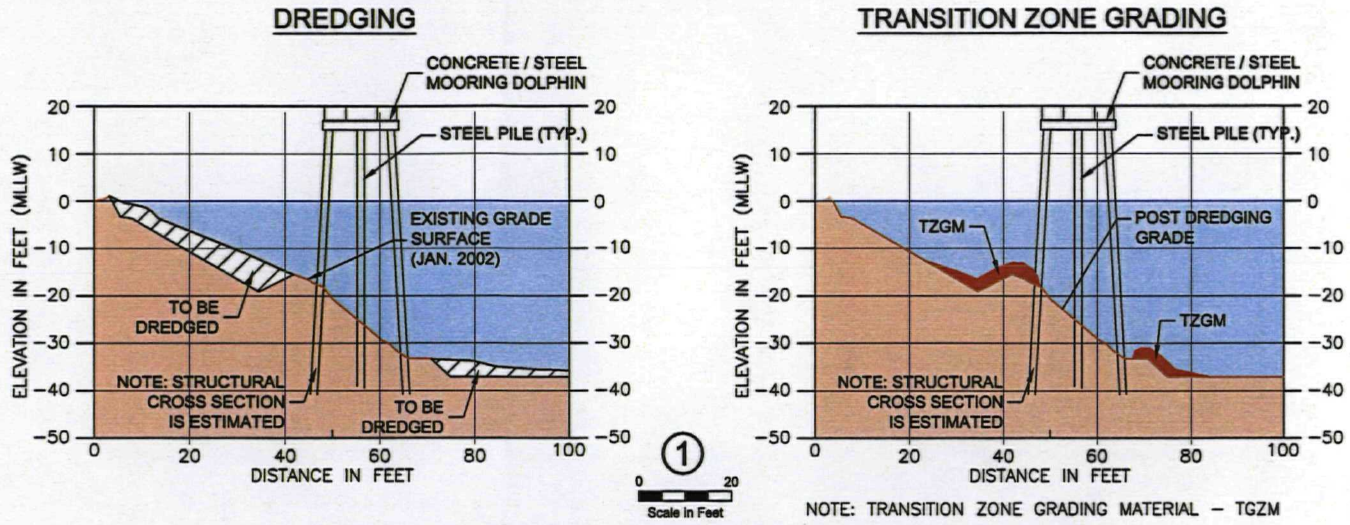
REV	DATE	BY	APP'D	DESCRIPTION

DESIGNED BY: R. WEBB/L. BARRAS
DRAWN BY: L. BARRAS
CHECKED BY: R. WEBB
APPROVED BY: P. FUGLEVAND
FILE: HCCG00102-37
DATE: 05/01/03

FINAL (100%) DESIGN 2003 REMEDIAL ACTION
HEAD OF HYLEBOS WATERWAY

TRANSITION AREA DETAILS
SHEET 1

DRAWING NO. C-71
PROJECT NO. HHCG00102
SHEET NO. 73 OF 91



NOTE: TRANSITION ZONE GRADING MATERIAL – TGZM

BOLLARD / DOLPHIN TRANSITION AREA DETAILS (TYP.) (2004)

ROBERT S. WEBB — STATE OF WASHINGTON — 35713 — REGISTERED PROFESSIONAL ENGINEER — PRELIMINARY

EXPIRES: 08/29/

DALTON, OLMSTED & FUGLEVAND, INC.
Environmental Consultants
10705 Silverdale Way NW Suite 201
Silverdale, WA 98383

REVISIONS

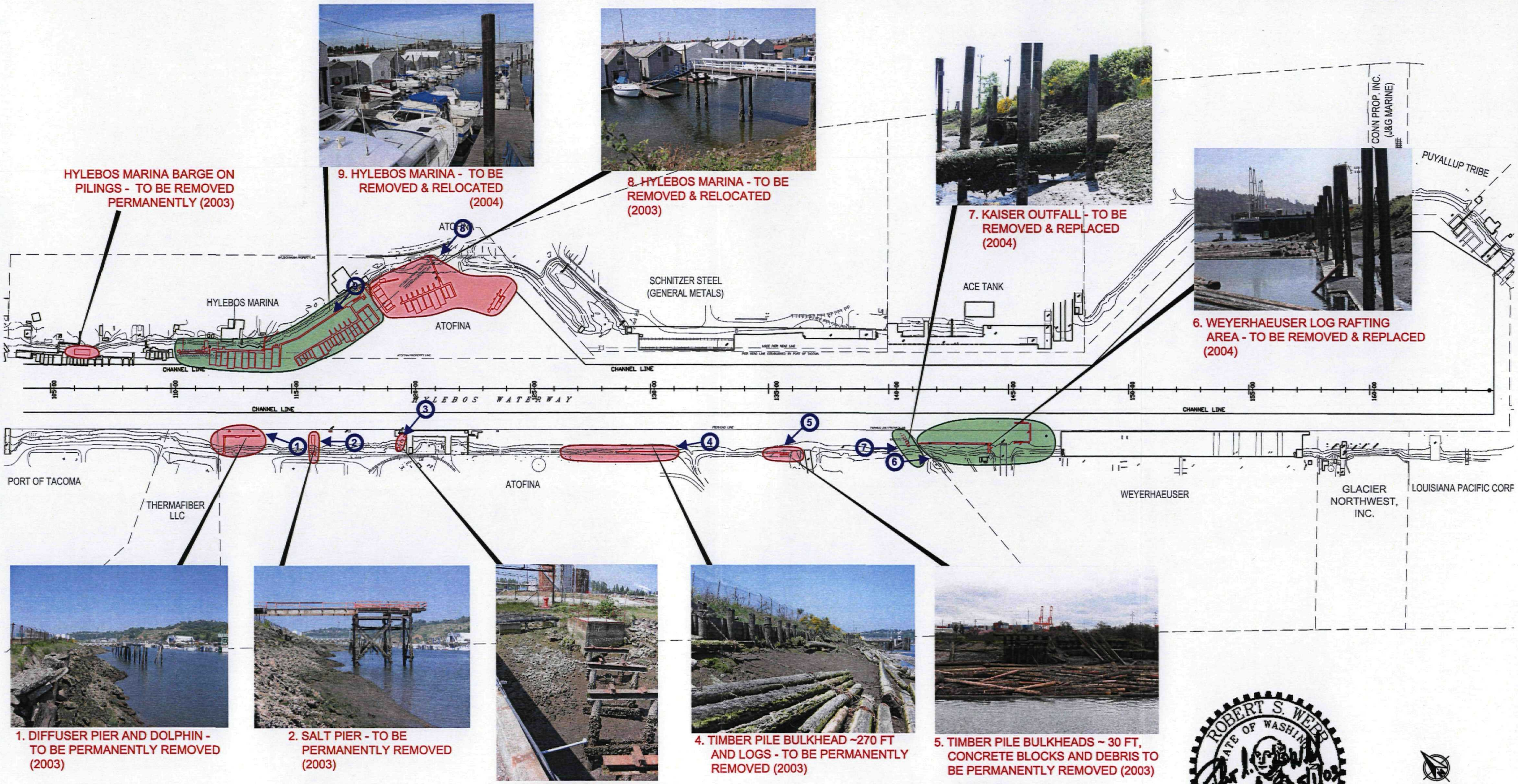
REV	DATE	BY	APP'D	DESCRIPTION

DESIGNED BY: R. WEBB/L. BARRAS
DRAWN BY: L. BARRAS
CHECKED BY: R. WEBB
APPROVED BY: P. FUGLEVAND
FILE: HCCG00102-37
DATE: 05/01/03

FINAL (100%) DESIGN 2003 REMEDIAL ACTION
HEAD OF HYLEBOS WATERWAY

TRANSITION AREA DETAILS
SHEET 2

DRAWING NO. C-72
PROJECT NO. HHCG00102
SHEET NO. 74 OF 91



GENERAL NOTES:

1. BASE MAP FEATURES AND CONTOURS PHOTOGRAMMETRICALLY MAPPED BY WALKER AND ASSOCIATES, MAY 2002.
2. PROPERTY LINE BOUNDARIES (OTHER THAN HYLEBOS MARINA AND SCHNITZER STEEL) DERIVED FROM CITY OF TACOMA PUBLIC WORKS DEPT. GIS DATA. THIS DATA IS APPROXIMATE AND MAY NOT REFLECT ACTUAL RECORDED SURVEYS. HYLEBOS MARINA AND SCHNITZER STEEL PROPERTY LINES FROM SITTS & HILL ENGINEERING RECORD OF SURVEY A.F.N. 2002211015001, NOVEMBER 2002.

LEGEND

- PERMANENTLY REMOVED
- TEMPORARY REMOVAL & REPLACEMENT
- PHOTO ID AND LOOK DIRECTION

ROBERT S. WEBB — STATE OF WASHINGTON — 35713 — REGISTERED PROFESSIONAL ENGINEER — 5/1/03

EXPIRES: 08/29/03

200 0 200
Scale in Feet

DALTON, OLMSTED & FUGLEVAND, INC.
Environmental Consultants
10705 Silverdale Way NW Suite 201
Silverdale, WA 98383

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REV	DATE	BY	APP'D	DESCRIPTION

DESIGNED BY: R. WEBB/L. BARRAS
DRAWN BY: L. BARRAS
CHECKED BY: R. WEBB
APPROVED BY: P. FUGLEVAND
FILE: HCCG00102-13
DATE: 05/01/03

FINAL (100%) DESIGN 2003 REMEDIAL ACTION HEAD OF HYLEBOS WATERWAY

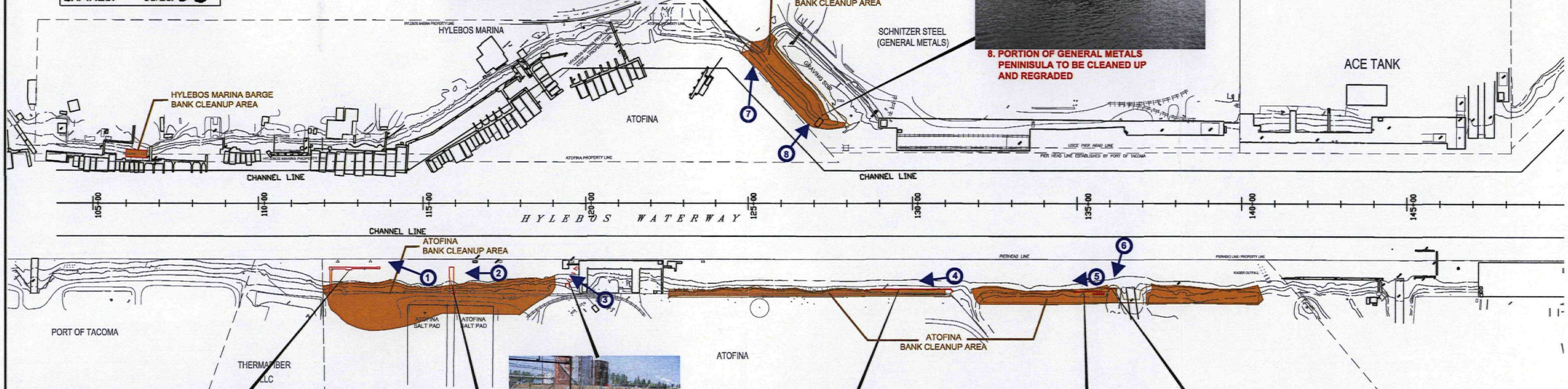
STRUCTURE ACTIVITIES MAP

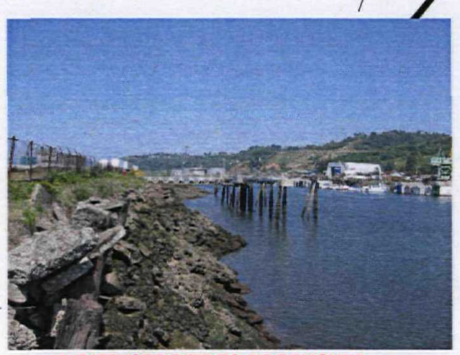
DRAWING NO. D-1
PROJECT NO. HHCG00102
SHEET NO. 75 OF 91

EXPIRES: 08/29/03

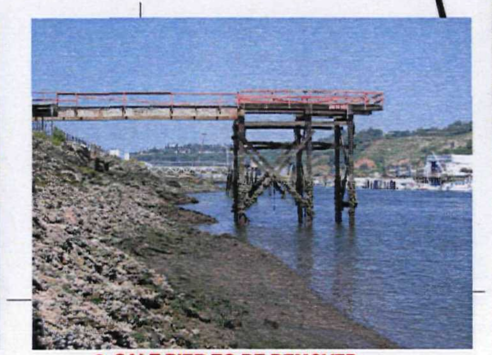
7. PORTION OF GENERAL METALS PENINISULA TO BE CLEANED UP AND REGRADED

8. PORTION OF GENERAL METALS PENINISULA TO BE CLEANED UP AND REGRADED





1. DIFFUSER PIER TO BE REMOVED PERMANENTLY



2. SALT PIER TO BE REMOVED PERMANENTLY

3. TRESTLE TO BE REMOVED PERMANENTLY

4. TIMBER PILE BULKHEAD ~270 FT AND LOGS TO BE REMOVED PERMANENTLY

5. MULTIPLE TIMBER PILE BULKHEADS ~100 FT, LOGS, STEEL DEBRIS AND PILINGS TO BE REMOVED PERMANENTLY

6. TIMBER PILE BULKHEADS ~ 30 FT, CONCRETE BLOCKS AND DEBRIS TO BE REMOVED PERMANENTLY

200 0 200
Scale in Feet

THIS PLAN SET APPROVED FOR 2003 REMEDIAL ACTIONS ONLY. 2003 REMEDIAL ACTION HIGHLIGHTED ON DRAWINGS.

NOTE: IN ADDITION TO THE ABOVE CALLED OUT STRUCTURES, ALL DERELICT PILINGS, LOGS, AND DEBRIS WILL BE REMOVED WITHIN THE BANK CLEANUP AREAS.

LEGEND

- STRUCTURE TO BE PERMANENTLY REMOVED
- 2003 BANK CLEANUP AREA
- PHOTO ID AND LOOK DIRECTION

DALTON, OLMSTED & FUGLEVAND, INC.
Environmental Consultants
10705 Silverdale Way NW Suite 201
Silverdale, WA 98383

GENERAL NOTES:

1. BASE MAP FEATURES AND CONTOURS PHOTOGRAMMETRICALLY MAPPED BY WALKER AND ASSOCIATES, MAY 2002.
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REVISIONS				
REV	DATE	BY	APP'D	DESCRIPTION

DESIGNED BY: R. WEBB/L. BARRAS
DRAWN BY: L. BARRAS/B. JOHNSTON
CHECKED BY: R. WEBB
APPROVED BY: P. FUGLEVAND
FILE: HCCG00102-42
DATE: 05/01/03

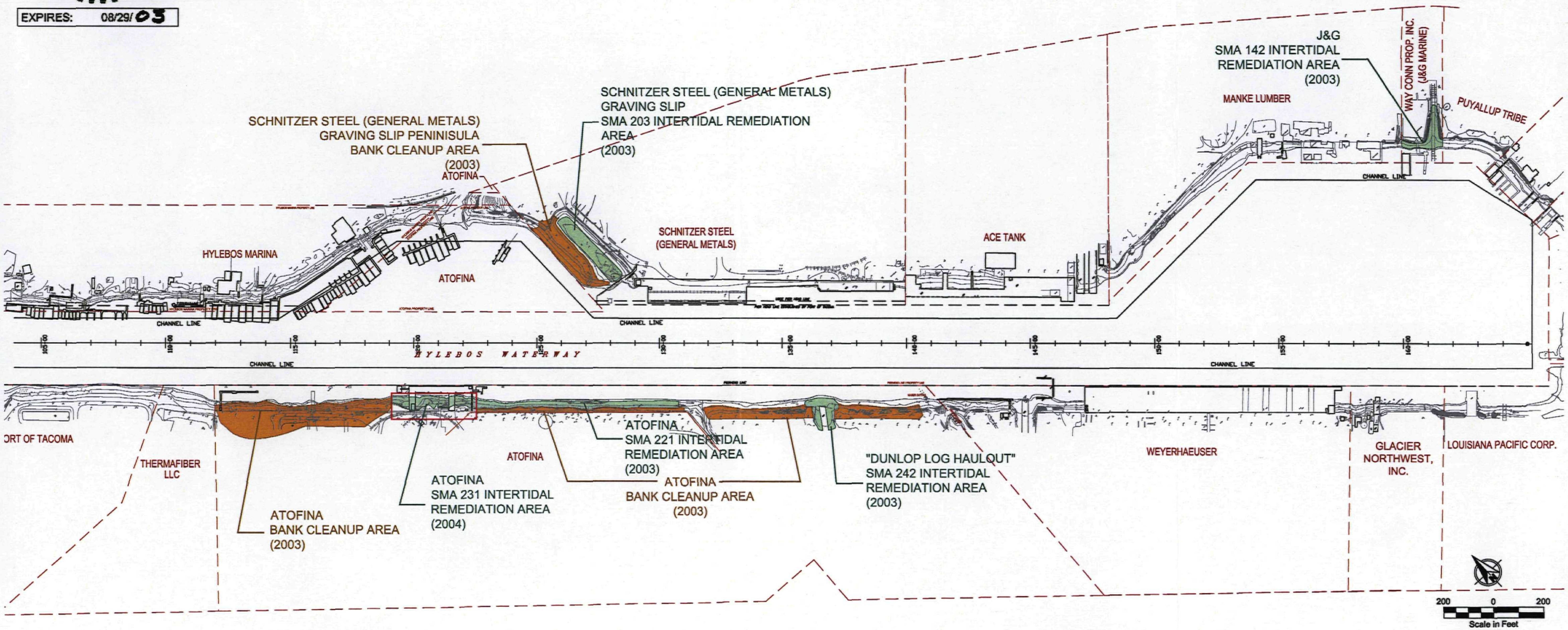
FINAL (100%) DESIGN 2003 REMEDIAL ACTION HEAD OF HYLEBOS WATERWAY

2003 DEMOLITION MAP

DRAWING NO. D-2
PROJECT NO. HHCG00102
SHEET NO. 76 OF 91

ROBERT S. WEBB
STATE OF WASHINGTON
35713
REGISTERED
PROFESSIONAL ENGINEER
5/1/03

EXPIRES: 08/29/03



GENERAL NOTES:
1. BASE MAP FEATURES AND CONTOURS PHOTOGRAMMETRICALLY MAPPED BY WALKER AND ASSOCIATES, MAY 2002.
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LEGEND
- INTERTIDAL REMEDIATION AREAS
- BANK CLEANUP AREAS

DALTON, OLMSTED & FUGLEVAND, INC.
Environmental Consultants
10705 Silverdale Way NW Suite 201
Silverdale, WA 98383

THIS PLAN SET APPROVED FOR 2003 REMEDIAL ACTIONS ONLY. 2003 REMEDIAL ACTION HIGHLIGHTED ON DRAWINGS.

REVISIONS

REV	DATE	BY	APP'D	DESCRIPTION

DESIGNED BY: R. WEBB/L. BARRAS
DRAWN BY: L. BARRAS
CHECKED BY: R. WEBB
APPROVED BY: P. FUGLEVAND
FILE: HCCG00102-29
DATE: 05/01/03

FINAL (100%) DESIGN 2003 REMEDIAL ACTION
HEAD OF HYLEBOS WATERWAY

LAND-BASED EXCAVATION AREAS
KEY MAP

DRAWING NO. IA-1
PROJECT NO. HHCG00102
SHEET NO. 78 OF 91

Appendix A
2003 Plans and Specifications

(Submitted under separate cover)

B - 2003 CQAP

Appendix B
2003 Construction Quality Assurance Plan

2003 CONSTRUCTION QUALITY ASSURANCE PLAN (2003 CQAP)

HEAD OF HYLEBOS WATERWAY PROBLEM AREA
COMMENCEMENT BAY NEARSHORE / TIDEFLATS SUPERFUND SITE
TACOMA, WASHINGTON

Prepared for Head of Hylebos Cleanup Group (HHCG)

- ATOFINA Chemicals, Inc.
- General Metals of Tacoma, Inc.

HHCG Approval

Signature ____________
Paul F. Fuglevand, Project Manager

Date 5/1/03

Signature R. S. Webb
Rob Webb, CQA Officer

Date 5/1/03

EPA Approval

Signature ____________
Peter Contreras, Site Manager

Date 5-7-2003

Signature ____________
QA Officer

Date ____________

NOT REQUIRED PC

Dalton, Olmsted & Fuglevand, Inc. *Environmental Consultants*

Silverdale, Washington
May 1, 2003

Table of Contents

2003 CONSTRUCTION QUALITY ASSURANCE PLAN (2003 CQAP)

1 Purpose

The purpose of this 2003 Construction Quality Assurance Plan (2003 CQAP) is to provide appropriate methodologies and requirements that insure the Remedial Action (RA) achieves the requirements set forth in the Record of Decision and Unilateral Administrative Order for the Site and that the RA complies with the EPA approved Remedial Design Documents.

This 2003 CQAP for the Remedial Action at the Head of Hylebos Waterway (Figure 1-1) is submitted by ATOFINA Chemicals, Inc. ("ATOFINA") and General Metals of Tacoma, Inc. ("General Metals"), collectively referred to in this plan as the Head of Hylebos Cleanup Group ("HHCG").

The HHCG is the Project Proponent for this Remedial Action. The purpose of the project is to meet established Sediment Quality Objectives (SQO's) within the Remedial Action Area. The Remedial Action will be performed in two phases. The first phase (2003 Work) will be the Remediation of intertidal Sediment Management Areas (SMA's) down to elevation 0 MLLW. The second phase (2004 Work) will be the remediation by dredging of the remaining portions of the site that are located below 0 MLLW.

This 2003 CQAP covers the first phase (2003 Work) and is submitted to satisfy Section IV Task 5 of the Head of Hylebos Waterway Statement of Work[1] (SOW), which is Attachment 4 to the Unilateral Administrative Order for Remedial Design and Remedial Action for the Head of Hylebos Waterway (UAO). A separate 2004 CQAP will be submitted to address Phase 2 (2004 Work) which includes the remediation of areas below elevation 0 MLLW.

The first phase of remedial actions (2003 Work) planned by the HHCG for the Head of Hylebos Waterway consist of upland based excavation of isolated intertidal areas, with upland disposal of excavated sediments and the demolition of existing structures. The intent of the cleanup plan is also to remediate the natural recovery areas with removal of impacted sediments except for SMA 122 located beneath the Weyerhaeuser dock.

The 2003 CQAP will be implemented in conjunction with the Shoreline Construction plans and specifications, the Head of Hylebos Operation, Maintenance and Monitoring Plan (OMMP) and the Head of Hylebos Water Quality Monitoring Plan (WQMP) and the Remedial Action Work Plan (RAWP) to promote the successful completion of the project.

---

[1] Statement of Work for the Unilateral Administrative Order for Remedial Design, Remedial Action & Long-Term Monitoring. Docket No. CERCLA 10-2002-0065. Head of Hylebos Waterway Problem Area: Segments 1 and 2. Commencement Bay Nearshore / Tideflats Superfund Site. Tacoma, Washington.

During the construction phase of the project the 2003 CQAP will be implemented by the Construction Quality Assurance Official (CQAO), who will be independent of the Remedial Action Contractor. The quality control tests and quality assurance program will be used to confirm compliance with the requirements of the design plans and construction documents.

Post-construction remedial action performance standards (or criteria) are provided in the OMMP. The 2003 CQAP describes the type and frequency of verifications, inspections and tests that are required to verify compliance with the criteria. The WQMP lists the type and frequency of tests that are required for monitoring of water quality during in-water work. The scope of construction work to be performed and methods of measurement and payment are described in the construction plans and specifications and the RAWP.

The existing EPA-approved Health and Safety Plan for sampling (HSP) and Quality Assurance Project Plan ("HCC-QAPP")[2] are incorporated by reference into this 2003 CQAP.

The contractor will prepare and submit all documents listed in the submittal register, including the following; a Project Schedule, Construction Quality Control Plan, Environmental Protection Plan and Remedial Action Site Health and Safety Plan. The required submittals which are germane to the 2003 CQAP are presented in Table 1. These contractor submittals are to be based upon this 2003 CQAP and the project plans and specifications. All documents will be provided to the HHCG and the RA oversight consultant in accordance with the schedule listed in the submittal register. Upon approval of the HHCG, these documents will then be submitted to EPA prior to the start of construction.

---

[2] Combined Sampling and Analysis Plan, Quality Assurance Project Plan, and Health and Safety Plan, Commencement Bay Nearshore/ Tideflats Superfund Site. Hylebos Waterway Problem Areas. Striplin Environmental Associates, Inc. February 22, 1994.

2 Elements of the 2003 CQAP

The 2003 CQAP is organized into the following sections;

- **Section 3 Project Roles and Responsibilities** presents the roles and responsibilities for the parties participating in the remedial action
- **Section 4 Contractor/Sub-contractor Qualifications** describes the required qualifications for the contractors and subcontractors performing the work
- **Section 5 Inspection Activities/Construction Monitoring** presents the inspection and oversight activities which will be performed to ensure project performance
- **Section 6 Remedial Action Construction Elements** describes the various construction elements
- **Section 7 Progress and Confirmation Sampling Methodology** describes the various construction elements
- **Section 8 Documentation and Reporting** summarizes the documentation and reporting requirements
- **Section 9 References** lists the references cited or used in the production of this development

3 Project Roles and Responsibilities

This section presents an overview of the roles and responsibilities for the parties involved in the remedial action. The roles and responsibilities for the performing parties and EPA are fully described in the UAO and are not changed by this document.

Construction Quality Control (CQC) inspections and testing are the responsibility of the Remedial Action Contractor, the HHCG and its consultant DOF. Specific elements of the quality control program may be delegated to subcontractors, as appropriate.

The CQAO is responsible for the quality assurance program. This program will be used to ensure that proper quality control inspections and tests are performed and documented by the contractor or others involved in the work.

The roles of each party are discussed in additional detail below.

3.1 US Environmental Protection Agency

The EPA is the regulatory authority and responsible agency for overseeing and authorizing the remedial action. In this capacity, EPA has reviewed project plans in the design phase and will review this 2003 CQAP to ensure that the monitoring is consistent with the remedial objective. An environmental monitor will be designated to exercise project oversight for the agency and to coordinate with the HHCG and its Consultants. The EPA will make final decisions to resolve unforeseen problems which may change the project components or the manner in which the construction is undertaken.

3.2 Head of Hylebos Cleanup Group (HHCG)

The Head of Hylebos Cleanup Group (HHCG) is responsible for performing the Remedial Action. The HHCG is comprised of ATOFINA Chemicals Inc. and General Metals of Tacoma, Inc. The construction project will be managed by the HHCG, with assistance from the DOF Project Manager and other staff, and executed by the Contractor(s) specializing in environmental remediation, dredging and construction. Onsite responsibility for construction oversight and contract administration will be assigned to a DOF Site Supervisor.

3.3 Construction Oversight Contractor (DOF)

Construction oversight will be performed by Dalton, Olmsted & Fuglevand (DOF), their subcontractors or designees. Activities to be performed by DOF include water quality monitoring, implementation of oversight elements as described within this 2003 CQAP, clarification of design elements and providing consulting services to the HHCG.

3.4 Remedial Action Contractor

The Remedial Action Contractor will perform the excavation, disposal and related construction elements necessary to complete the Remedial Action. Subcontractors may be employed by the Remedial Action Contractor to perform portions of the work. The Contractor will be required to perform all activities in accordance with the EPA approved plans including implementation of all required BMP's. The Remedial Action Contractor will have a designated supervisor onsite for coordination of all work.

3.5 Subcontractors

The Remedial Action Contractor or DOF may employ subcontractors to perform selected phases of the work for which they have special expertise. An example of this would be a Land Surveyor for construction layout and monitoring and for performing as built surveys. The subcontractors are responsible to the prime contractor for the quality of their work and health and safety of their personnel in accordance with the Contractor's Construction Quality Control (CQC) Plans and Remedial Action Health and Safety Plan (RAHASP). Any subcontracted work must be specifically described within the contractors RAHASP, work plan and CQC Plan or appropriate addendum submitted to HHCG for approval. The subcontractor's principals will designate a job site superintendent or foremen with responsibility to see that their work is conducted in accordance with the contract requirements.

3.6 Consultants

During the course of construction, additional consultants may be utilized to ensure that the design objectives are realized and that the project is constructed in accordance with the remedial design documents, plans and specifications.

3.7 Landfill

The landfill will assist in the evaluation of the materials planned for excavation which are designated for landfill disposal.
The procedure for evaluation of material for landfill disposal will be as follows:

- The HHCG provides landfill with analytical testing results, including the results of the ATOFINA borings and the test pits.
- The landfill determines if additional characterization is required for the materials.
- The HHCG completes the landfill-defined additional characterization, consistent with the requirements of the landfill's permit.
- Landfill determines if any material should be designated as dangerous waste.
- EPA is notified of the presence of any dangerous waste materials.
- HHCG and Landfill establish how to sequence and dispose of dangerous waste in accordance with solid and dangerous waste regulations, and will submit a plan to EPA for review and approval.

4 Remedial Action Contractor/Subcontractor Qualifications

Prior to contract award, each prospective Contractor must demonstrate through pre-qualifications conducted by the HHCG and DOF that it has the expertise, experience, and capability to successfully complete the work. These contractors must maintain, within their permanent organization, high caliber, knowledgeable, and experienced staff to perform their projects. These individuals will have experience in the type of work being contracted. All of the Contractor personnel performing key jobs must have demonstrated the ability and skills necessary to satisfactorily perform those assignments.

For this project, the On Site Remedial Action Contractor Project Supervisor will be required to have at least 5 years experience in the type of work being contracted for. The

Contractor's Project Supervisor will be onsite daily and have responsibility and authority for all quality related operations performed by the contractor. Beyond this, the Contractor's Quality Control Manger must have documented qualifications and experience to perform the checks on the Contractor's operations necessary to determine compliance with the contract provisions.

Any subcontractors utilized in the work must have demonstrated to the satisfaction of the HHCG and DOF that they are qualified and experienced in the type of work to be performed. Any subcontractors must be approved by the HHCG prior to their start of work. Responsibility for subcontractor performance rests with the prime contractor by which they are contracted.

5 Inspection Activities/Construction Monitoring

Inspection and monitoring will be performed at various times throughout the project. The inspection and monitoring frequencies have been developed to coincide with the overall project impacts of that construction element and to verify performance at critical points during the project.

5.1 Contractor/Engineer Responsibilities

The Contractor will be responsible for all Quality Control during performance of the work. The Contractor will use methods described within their project specific CQC Plan to insure project performance and compliance with approved plans and specifications.

The CQA Official (CQAO) will be responsible for Quality Assurance (QA) during construction.

5.2 Construction Quality Assurance Official (CQAO)

The CQAO will conduct sufficient inspections, independent sampling and testing, and monitoring activities to assure that the terms and conditions of the contract are being complied with by the contractor. Table 2 summarizes the anticipated monitoring and frequency for each of the remedial activities. The results of these inspections, sampling and testing, and monitoring activities will be documented as specified in Section 6, Documentation and Reporting.

Any work found not to be in accordance with the contract requirements will be immediately brought to the attention of the Contractor's Onsite Project Supervisor for correction and annotated on the "Quality Assurance Report," together with the corrective action taken or planned.

Any work found not to be in accordance with the approved remedial design plans; specifications, work plans, and/or documents shall be brought to the immediate attention of the HHCG who will notify EPA. Any changes to EPA-approved documents will have EPA approval before being implemented, if possible without undue impacts upon project schedule. Because the remedial action may be performed on a variable schedule to coincide with periods of low tide, the implementation of non-EPA approved changes may be required if EPA cannot be reached. In such an occurrence, the changes will be implemented and then reviewed with EPA when contact with the EPA is established.

Responsibilities of the CQAO include, but are not limited to, the following:

- Monitoring quality control activities to ensure conformance with authorized policies, procedures, and sound construction practices, as well as recommending improvements, as necessary

- Conducting meetings with site personnel covering the requirements of the construction quality control procedures and 2003 CQAP, as appropriate to insure project success

- Performing inspections and surveillances of the construction team and its subcontractors' project activities to ensure that project procedures are being followed and project objectives achieved

- Identifying, and resolving nonconformance's in accordance with the requirements of the construction quality control procedures and 2003 CQAP

- Monitoring corrective action documentation for conditions adverse to quality, verifying implementation of corrective actions, tracking and analyzing corrective action, and providing closeout corrective action documentation upon completion.

5.2.1 Prior to Construction

Necessary inspections will be performed by the CQAO prior to the start of construction. Prior to the start of any construction, the CQAO will inspect all equipment and materials to be used by contractor which can affect the quality of the project and to verify compliance with project documents. Items to be specifically included during preconstruction inspections include stakeout of the planned work area, location and condition of debris boom and control to be used during excavation and material placement.

A pre-construction meeting will also be held at which time all construction practices as related to the quality of the completed project will be discussed.

5.2.2 During Construction

During construction, the CQAO will conduct regular monitoring, observations and testing as needed to verify the quality of the work. Examples of these verifications and monitoring are described below. Additional qualitative monitoring may be implemented as necessary during performance of the project.

- Checks on excavation location and depth (X, Y and Z). These will be performed using a variety of methods including contractor performed surveys and Oversight contractor surveys, observations or measurements. This is critical to ensure impacted sediments are removed.

- Verification of compliance with water quality monitoring procedures. Water Quality Monitoring to be performed in accordance with the EPA-approved Water Quality Monitoring Plan.

- Verification that Water Quality Standards as set forth in the project Water Quality Certificate issued by EPA are not exceeded.

- Verification that Best Management Practices (BMP's) are properly used by the contractor during the project.

- Verification that Debris Boom is in place during performance of intertidal or overwater work.

- Verification of on-site water management practiced by Contractor. This is to include management of excessive stormwater.

- Verification that sediments from Intertidal SMA's are loaded for offsite transport and disposal in accordance with project documents.

- Verification that Contractor is complying with "Standard Habitat Measures" or "Additional Habitat Measures" as appropriate

During construction Daily tailgate meetings will also be held at which time the days activities and quality related elements will be discussed. Additional meetings will be held at the start of each new portion of the work including Bank Cleanup, various Intertidal Areas and various demolition elements.

5.2.3 Post Construction

Following construction the CQAO will:

- Insure that post construction confirmation sampling is performed in accordance with procedures described in the project documents (Intertidal SSOP and OMMP).

- Prepare final Post Construction (2003) Quality Assurance Report and other Letter/Reports as discussed in Section 9 of this document.

6 Remediation Action Construction Elements

This 2003 CQAP addresses construction elements associated with the remediation of the impacted intertidal areas including excavation and transportation and off-site disposal of sediments. Each element has discussions of one or more of the following:

Description. Description of the tasks for construction activities;

Potential Problems, Concerns, and Remedies. A description and evaluation of potential construction concerns, sources of information regarding potential problems, and common or anticipated remedies;

Monitoring, Contingency Plans, and Corrective Actions. A plan for monitoring to be performed during remediation, required laboratory tests and their interpretation, a schedule of monitoring tasks and date when they terminate, a description of threshold or triggering criteria, a contingency plan that describes construction alternatives in the event of a failure (to prevent undue hazard), and an evaluation of design vulnerability and environmental human health risks in the event of failure.

For all construction activities, the Contractor shall furnish for review by the Construction Oversight Contractor (DOF) and the HHCG, within 10 calendar days of award, it's CQC Plan. This plan will be used to document the inspections, monitoring, surveys and other actions to be taken by the Contractor to ensure that the work complies with all contract requirements. The Contractor shall assure that all required gauges, targets, ranges and other survey markers are in place and properly maintained.

As part of the ongoing quality assurance activities, the CQAO will monitor compliance with the CQC plan. Any necessary corrective actions will be brought to the attention of the Contractor's General Superintendent and documented in the Quality Assurance Report by the CQAO. These actions will also be brought to the attention of EPA, as described below. Also, pursuant to the Remedial Action Health and Safety Plan (RAHASP), the Contractor will submit its site specific Health and Safety Plan which covers the controls, work practices, personal protective equipment, and other health and safety requirement that will be implemented by the Contractor in connection with the remedial action activities. A similar site specific Health and Safety Plan will be required for all subcontractors.

6.1 Construction Element Sequence

The Construction Element Sequence will be presented in the Final 2003 CQAP.

A general sequencing of the necessary construction elements is as follows;

a) Pre-RA Shoreline Sediment Characterization at ATOFINA

b) Bank Cleanup (upland based excavation of non-SMA shoreline areas)
c) Intertidal SMA Remediation (upland based remediation of SMA's)
d) Material placement (Transition Zone Grading, Spalls and Large Woody Debris placement)
e) Demolition Activities
f) Soil Screening to remove debris

6.2 Pre-RA Sediment Characterization at ATOFINA

6.2.1 Test Pits

Test pits are planned along the ATOFINA shoreline to better characterize the nature of material to be excavated, with a primary focus on the nature of debris. The excavations will be advanced by the remediation contractor utilizing the excavator equipment mobilized to the site for the cleanup, and will extend to the depth of excavation indicated on the cross sections of the project drawings.

The materials exposed in the walls and floor of each test pit will be described in a field log. The nature and extent of exposed debris will be qualitatively described, along with the grain-size characteristics of the soil matrix.

Two soil samples will be collected from the test pits along the ATOFINA shoreline shown on Figure S-1 of the SSOM to represent the material that will be exposed by the intertidal remediation. The samples will be collected near elevations 5' and 10' MLLW of the anticipated final surface. One sample will be collected from the ATOFINA test pits shown on Figure S-2 of the SSOM at the elevation exposed by the bank cleanup process. The samples will be submitted for analytical testing as described in the SSOM.

The test-pit sampling results will be used to determine if any revisions will be required to the 2003 RA Work Plan, as follows:

- **No Revisions to Work Plan**: Test-pit sampling sub-areas with no analytical results exceeding the SQOs will be considered to have met the cleanup objectives of the ROD and ESD, with no revisions required to the 2003 RA Work Plan.

- **Work Plan Addendum**. Test-pit sampling sub-areas with some analytical results that exceed some of the SQOs will require a work plan addendum to be submitted to EPA within 30 days of receipt of the data. The work plan addendum will be for evaluating and developing a revised cleanup approach for the effected sub-areas, with the revised cleanup to be completed no later than the end of the 2004 construction season.

6.2.2 Intertidal Characterization Samples

The original Pre-Remedial Design intertidal sampling for Hylebos Waterway subdivided the shoreline into reaches of similar ownership and upland activities. The intertidal sampling areas were typically on the order of a couple hundred feet in length, ranging from 50 to 1,000 feet in length. Multiple samples were collected from within each shoreline area and composited for testing.

Prior to initiation of cleanup, the following intertidal cleanup areas will be resampled to refine the extent of the intertidal area requiring cleanup:

- ATOFINA Intertidal Dock (SMA 231) Figure S-1 of SSOM

For the purpose of sampling, each of the intertidal remediation areas is divided into specific Intertidal Sampling Areas no larger than 5,000 square feet, as shown on Figures S-1 in the SSOM. Consistent with the 1B SAP, each Intertidal Sampling Area is subdivided into 50-ft. long sub-areas. A surface core will be collected from roughly the center of each sub-area for testing, as summarized on Table S-1.

Each discrete sample will be analyzed for the target parameters referenced on Table S-1 of the SSOM, as discussed in Section 4.1 of the SSOM.

The intertidal characterization sampling results will be used to classify each intertidal sampling sub-area one of the three categories

- **<u>Intertidal Clean</u>**: Intertidal sampling sub-area with no analytical results exceeding the SQOs will be considered to have met the cleanup objectives of the ROD and ESD.

- **<u>Intertidal Natural Recovery</u>**. Intertidal sampling sub-areas with some analytical results which exceed the SQO, but not more than two times the SQO (450 ug/kg PCBs maximum) are normally defined as natural recovery areas in accordance with the ROD and ESD. However, intertidal excavations will be completed in intertidal sampling sub-areas classified as natural recovery areas by the characterization sampling.

- **<u>Intertidal Impacted</u>**. Intertidal sampling sub-areas with one or more compounds exceeding 2 times the SQO (450 ug/kg PCBs) will be classified as intertidal impacted. Intertidal excavations will be completed in intertidal sampling sub-areas classified as intertidal impacted areas by the characterization sampling.

6.3 Bank Cleanup

Description
This includes all excavation and cleanup to be performed outside of the limits of the SMA's. Waterway banks will be excavated to lines and grades shown on the plans and specifications. Existing debris will be removed from the shorelines within the designated cleanup areas.

Potential Problems, Concerns, and Remedies
Potential problems related to the upland excavation include the discovery of unknown large debris or constructed items within the excavation area or the discovery of previously undiscovered chemically impacted materials. Known utilities will be marked by contractor (one call system) prior to any excavation.

Damage to the existing sheetpile cut off wall located behind and east of the ATOFINA Dock is to be avoided. Wall to be field located by contractor and staked or otherwise marked prior to excavation in that area.

Monitoring, Contingency Plans and Corrective Action
Location of all utilities will be required prior to any excavation. Contractor field location of sheetpile wall will be verified prior to excavation in that area.

As previously described, test pits and associated chemical analyses will be performed within areas of Bank Cleanup at the ATOFINA site. Results from the test pit activity will be used to modify the planned bank cleanup as appropriate. This may include the reduction or expansion of the planned bank cleanup if significant areas of contamination are discovered. If any materials suspected of contamination are discovered during excavation of the Bank Cleanup areas, confirmation samples of the remaining excavated surface will be collected and analyzed, as per procedures listed in the SSOM.

If samples indicate the exposed excavated surface is not less than 2x SQO's, additional excavation may be performed to attempt to excavate materials which are greater than 2x SQO's and produce a resulting surface which is less than 2x SQO's. Any areas which are additionally excavated will require additional confirmation sampling of the final surface. If the area cannot be excavated such that the final surface is less than 2x SQO's, the location of the area will be recorded, the area will then be covered with TZGM and readdressed during the 2004 Remedial Action.

Acceptance Requirements
Acceptance requirements for upland excavation include the excavation to lines and grades as shown on the plans and specifications or as directed by the HHCG to remove all Recent sediments or other impacted material and the adherence to all other project requirements including BMP's.

6.4 Intertidal SMA Remediation

Description

Excavation will be performed to a depth of approximately three feet below existing grade in the intertidal SMA's designated for remediation as shown in the plans. The objective of the excavation is to remove all recent sedimentation and any impacted sediments. Excavation will be performed by land based equipment working at low tidal conditions. Working at low tide will allow the work to be performed above the water surface.

Potential Problems, Concerns, and Remarks

Typical problems with intertidal work relate to incomplete removal of the SMA, work schedule, unknown subsurface conditions and failure to excavate to required depths or elevations.

SMA excavation area will be clearly marked in the field by the contractor prior to excavation. Work must be scheduled in increments that can be accomplished within the available tidal window. Failure to adequately schedule the work and adjust the schedule based upon site and daily conditions can produce negative results associated with tide level rising prior to completion of task.

A floating debris boom will be installed around the intertidal excavation area prior to its excavation to prevent releases to the waterway.

Monitoring, Contingency Plans and Corrective Action

Monitoring will be performed to verify that scheduled work is of reasonable extent and duration for predicted tidal conditions.

Verification sampling will be performed by the Construction Oversight Contractor to insure that required excavation has been performed, exposing clean sediment within the excavation limits. TZGM shall not be placed within intertidal remediation areas until confirmation sample results have been analyzed indicating that project objectives have been accomplished.

Acceptance

The Construction Oversight Contractor monitoring and the associated acceptance parameters are presented in the Shoreline Remedial Action Work Plan and are repeated in Section 7 of this document.

6.5 Material Placement

Description

This includes the placement of imported materials within the cleanup or remediation Areas. Imported materials to be used during this project include;

A. Transition Zone Grading Material (TZGM)
B. Quarry Spalls
C. Boulders
D. Large Woody Debris (LWD)

Transition Zone Grading Material (TZGM)

TZGM will be used to top dress all areas where indicated on the plans to establish a smooth slope free of depressions that might otherwise result in entrapment of juvenile salmonids or other fish with a falling tide. TZGM will not be placed on Intertidal Remediation sampling areas until confirmation sampling confirms the cleanup is complete for that sampling area. Additional excavation may be required based upon results of sample analysis. Any additional excavation would require additional sampling prior to TZGM placement

Material will be placed and graded to establish a smooth surface free of depressions that might otherwise result in entrapment of juvenile salmonids or other fish with a falling tide, at the 2003 land based excavations shown on Drawing IA-1 of the Project Plans, or as otherwise directed by the HHCG. Material will generally be placed as a minimum one foot layer and tapered to match existing grades. Thicker placements of TZGM will be used at edges of excavations to flatten or buttress slopes as needed.

Transition Zone Grading Material is to meet the following specification;

> The transition zone grading material will be a well-graded sand and gravel material composed of naturally rounded rock (no crushed rock). Two potential sources of the material are 1) the sand and gravel pits located near the Head of Hylebos Waterway, as was used for the Ace Tank cleanup on Hylebos Waterway, and 2) the Glacier Pioneer Aggregate Plant #1 (Dupont Area) material that was used as habitat mix by the City of Tacoma for the Thea Foss Esplanade project.
>
> The grain size criteria for the Transition Zone Grading is as follows

Grain Size Criteria for Transition Zone Grading

Sieve Size	*Percent Passing*
6" square	100%
US No. 4	80% max
US No 40	50% max
US No. 200	10% max

Potential Problems, Concerns, and Remarks

Potential Problems relate to improper gradation, chemical contamination or improper placement of material.

Monitoring, Contingency Plans and Corrective Action

Upon location of material source which meets the required specification, the CQAO and EPA will be notified and allowed to inspect the material at the source. EPA will be given a minimum of five days notice prior to placement of material. Sample collection and analyses will be performed as per the SSOM. Additional visual inspection of the material by the contractor and CQAO will occur at the site prior to placement. EPA and ESA agencies will also be notified five (5) days prior to material placement to allow for agencies to conduct field visits if desired.

Prior to import to the site, samples of the proposed TZGM will be collected by the CQAO or their designee at the material source and analyzed for the following;

i. Specific gravity of uncompacted materials.
ii. Weight per unit volume of uncompacted materials.
iii. Grain Size Distribution (ASTM D 422-63)
iv. Laboratory analysis per SSOM

Sample collection and analyses will be performed as per the SSOM. The results of such tests will be provided to EPA at least five days before placement of the material. The results will be provided in report form where the reports clearly identify the following:

1. Source of samples
2. Sampling dates
3. Chain of custody
4. Sampling locations
5. Certification that the samples tested and the results provided are representative of the materials that shall be delivered to the site.

Surveys of completed sections of the shoreline will be performed to verify the extents and final grade of the TZGM. .

Acceptance

Acceptance will be based upon the proper placement of material meeting specifications within the designated areas. This will be confirmed based upon as built surveys of the project area, field measurements, and field inspection of the placed material.

Materials improperly placed or not meeting specification will be corrected.

<u>Quarry Spalls</u>

Quarry Spalls will be used prevent future erosion of the General Metals Peninsula following the bank cleanup of that area.

Material will be placed using land based equipment to the lines and grades indicated on the plans and specifications. Spalls will generally be placed as a minimum one foot layer.

Quarry Spalls are to meet the following specification;

> Material shall be of good quality rock, without significant fractures or friable material and shall conform to Section 9-13. 6 of the WSDOT Standard as shown below:

Grain Size Criteria for Quarry Spalls

Size	*Percent Passing*
8"	100%
3"	40% max
3/4"	10% max

Potential Problems, Concerns, and Remarks

Potential Problems relate to improper gradation or placement of material.

Monitoring, Contingency Plans and Corrective Action

Upon location of material source which meets the required specification, The Construction Oversight Contractor will be notified and allowed to inspect the material at the source. Additional inspection of the material by the contractor and Construction Oversight Contractor will occur at the site prior to placement.

Surveys of completed sections of the shoreline will be performed to verify that Spalls have been placed to lines and grades indicated in the plans and specifications.

Acceptance

Acceptance will be based upon the proper placement of material meeting specifications within the designated areas. This will be confirmed based upon as built surveys of the project area, field measurements, and field inspection of the placed material.

Materials improperly placed or not meeting specification will be corrected.

Boulders

Boulders will be placed on the crest of the General Metals Peninsula following the bank cleanup and placement of spalls and TZGM in that area.

Boulders will be placed using land based equipment as indicated on the plans and specifications.

Boulders shall be of good quality, without significant fractures and approximately 4' in diameter. Boulders are to be naturally rounded, if available.

Potential Problems, Concerns, and Remarks

Potential Problems relate to improper size, quality or placement of material.

Monitoring, Contingency Plans and Corrective Action

Upon location of material source which meets the required specification, The Construction Oversight Contractor will be notified and allowed to inspect the material at the source. Additional inspection of the material by the contractor and Construction Oversight Contractor will occur at the site prior to placement.

Materials improperly placed or not meeting specification will be corrected.

Acceptance

Acceptance will be based upon the proper placement of material meeting specifications within the designated areas. This will be confirmed using field measurements, and field inspection of the placed material.

Large Woody Debris

Large Woody Debris will be placed on the crest of the General Metals Peninsula following the bank cleanup and placement of spalls and TZGM in that area. LWD placement will be coordinated with placement of Boulders.

LWD shall be of good quality, consisting of approximately 40' long, 12 to 18 inches in diameter trees with intact root mass. Bark shall remain intact.

LWD will be placed using land based equipment as indicated on the plans and specifications and firmly anchored in place using chain and anchors.

Potential Problems, Concerns, and Remarks

Potential problems relate to improper size, quality or placement of material. Material must be properly anchored in place to prevent future movement.

Monitoring, Contingency Plans and Corrective Action

Upon location of material which meets the required specification, The Construction Oversight Contractor will be notified and allowed to inspect the material at the source.

Additional inspection of the material by the contractor and Construction Oversight Contractor will occur at the site prior to placement.

Materials improperly placed or not meeting specification will be corrected.

Acceptance
Acceptance will be based upon the proper placement of material meeting specifications within the designated areas. This will be confirmed using field measurements, and field inspection of the placed material.

6.6 Demolition Element

Description
The demolition of existing structures in several areas will be required in order to complete this phase of the RA. This includes demolition of shoreline structures and in water structures.

Shoreline Structures include the land side connection of the diffuser pier, land side connection of the Salt Pier, several piling supported concrete bollards and several hundred feet of timber bulkhead, located at the ATOFINA site. At the Hylebos Marina, an old piling supported barge will be removed.

Demolition of in-water structures including the Kaiser Outfall, ATOFINA Diffuser Pier, ATOFINA Salt Dock, Weyerhaeuser log handling area and portions of the Hylebos Marina will be performed using floating equipment.

Potential Problems, Concerns, and Remedies
Typical problems encountered during demolition include debris entering the waterway and failure to completely remove the structure. Pilings to be removed may have a tendency to break off at or near the mudline, resulting in the incomplete removal of the pile.

Monitoring, Contingency Plans and Corrective Action
Proper BMP's will be employed during demolition to ensure debris does not enter the waterway. Any floating debris will be promptly removed from the waterway for disposal.

All in water structures scheduled for demolition are located within the dredge footprint. Therefore, any items not completely removed during the demolition phase would be recovered during the dredge operation, resulting in their complete removal.

Acceptance Requirements

Acceptance of demolition work will be based upon the complete removal of all portions of the structure and proper disposal or recycling of the demolished items

7 Progress and Confirmation Sampling Methodology

7.1 Confirmation Sampling of Intertidal Excavations

The intertidal excavations will focus on removal of intertidal Recent sediment that typically contains anthropogenic material (such as debris or sand blast grit) and is visually distinct from the underlying Native sediment. Once such material has been removed from an area, based on visual observations, then confirmation monitoring data will be collected, as detailed below.

The confirmation sampling program for the 2003 Intertidal Remediation is based on the methods presented in the Hylebos Cleanup Committee (HCC) document titled Sediment Sampling for Event 1B ("1B SAP"), which was developed for the investigation of the Intertidal areas of the Hylebos Waterway. The intertidal sampling completed under the SSOM will use the same sampling equipment (hand-held cores), will sample the same depth (10 cm) of sediment, and use the same analytical methods as the Event 1B Intertidal program.

For the purpose of sampling, each of the intertidal remediation areas is divided into specific Intertidal Sampling Areas no larger than 5,000 square feet, as shown on figures in the Sediment Sampling Operations Manual (SSOM). Consistent with the 1B SAP, each Intertidal Sampling Area is subdivided into 50-ft. long sub-areas. A surface core will be collected from roughly the center of each sub-area, with all cores from an Intertidal Sampling Area composited into one sample for testing.

The target parameter list for the intertidal remediation areas are those compounds shown by the Pre-Remedial Design (Figure 2-1 of the Basis for Design Report) to exceed the SQO chemical criteria within the specified area. Specific target parameter lists for each of the identified intertidal remediation areas are presented on Tables 4-3 through 4-7 of the SSOM.

The intertidal confirmation sampling results will be used to classify each Intertidal Sampling Area one of the three categories

- **<u>Intertidal Clean</u>**: Intertidal Sampling Areas with no compounds exceeding the SQOs will be considered to have met the cleanup objectives of the ROD and ESD.

- **<u>Intertidal Natural Recovery</u>**. Intertidal Sampling Areas with some compounds which exceed the SQO, based on confirmation sampling, but not more than two times the SQO (450 ug/kg PCBs maximum) will be defined as natural recovery areas in accordance with the ROD and ESD. Respondents may propose natural recovery (including enhanced natural recovery) for such areas, or may complete further remedial action until the Intertidal Clean status is achieved.

- **<u>Intertidal Impacted</u>**. Intertidal Sampling Areas with one or more compounds exceeding 2 times the SQO (450 ug/kg PCBs) will be subject to further investigation and remediation, until confirmation sampling establishes either a Intertidal Clean or Intertidal Natural Recovery condition.

Samples which are found to contain recent material or other obvious indication of contamination (visual, olfactory, or sheens) will not be mixed with samples of native material for composite analysis. Areas with samples exhibiting such characteristics will either be subject to additional removal or discrete sample analysis.

8 Project Meetings

8.1 Preconstruction Inspection and Meeting

The HHCG and its consultants shall participate with EPA and the State in a preconstruction inspection and meeting to:

1. Review methods for documenting and reporting inspection data, and compliance with specifications and plans including methods for processing design changes and securing EPA review and approval of such changes as necessary;

2. Review methods for distributing and storing documents and reports;

3. Review work area security and safety protocol;

4. Demonstrate the construction management is in place, and discuss any appropriate modifications of the construction quality assurance plan to ensure that Site-specific considerations are addressed; and

5. Conduct a Site walk-about to verify that the design criteria, plans, and specifications are understood and to review material and equipment storage locations.

All inspections and meetings will be documented by the HHCG and minutes shall be transmitted to all parties within seven (7) working days of the inspection or meeting.

8.2 RA Briefings and Progress Meetings

The HHCG and its consultants will conduct RA briefings and progress meetings on a regular basis throughout the RA. Briefings will be held on a weekly basis to discuss issues such as the results of ongoing water quality monitoring and field changes unless EPA and Respondents agree to a less frequent schedule. Progress meetings will be held at least monthly unless EPA and Respondents agree to a less frequent schedule. Progress meetings will be scheduled on the same day that weekly briefings occur, thus eliminating the need for additional briefings during that week. At a minimum, the following will be addressed at progress meetings:

- General progress of construction with respect to RA schedule;
- Problems encountered and associated action items;
- Pending design, personnel or schedule changes requiring EPA review and approval;
- Results of any RA verification sampling and associated decisions and action items.

8.3 Prefinal Construction Inspection

Within thirty (30) days after the HHCG determines that construction is complete for each discrete element of the remedial action, as defined in the Final Remedial Action Work Plan, the Respondents will notify EPA and the State for the purposes of conducting a prefinal inspection.

The prefinal inspections will consist of a walk-through inspection of the entire completed remedial action element with EPA. The inspection will determine whether the project element is complete and consistent with the contract documents and the Remedial Action Work Plan, to review compliance with the CQAP, and to review field changes and change orders, and verify that SQOs have been achieved. The Respondents will certify that each discrete element of the remedy has been constructed to meet the purpose and intent of the specifications. The HHCG will complete re-testing where deficiencies are revealed. Within seven (7) days of the inspection, a prefinal construction inspection letter/report shall be submitted to EPA as described in section 9.2.1 of this 2003 CQAP.

8.4 Final Construction Inspections

Within thirty (30) days after completion of any work identified in the prefinal inspection reports, the HHCG will notify EPA and the State for the purposes of conducting a final inspection of each discrete remedial action element. The final inspection will consist of a walk-through inspection of each discrete element of the remedial action by EPA and the Respondents. The prefinal inspection reports will be used as a checklist with the final inspection focusing on the outstanding construction items identified in the prefinal inspections. Confirmation will be made that outstanding items have been resolved. Resolution of all outstanding items will be documented in a Final Construction Letter/Report within thirty (30) days of the final inspection, which complies with Section IX of the UAO. The Final Construction Letter/Report is described in section 9.2.1 of this 2003 CQAP.

9 Documentation and Reporting

9.1 During Remedial Action Construction

This section provides a description of procedures for maintaining and updating activity logs, laboratory records, procedures for reporting emergencies, records for personnel and maintenance, and monthly reports to agencies. The 2003 CQAP includes a description of how change orders will be reviewed for design consistency.

9.1.1 Contractor Responsibilities

The Remedial Action Contractor will be required to submit daily production and quality control reports to the Construction Oversight Contractor (DOF). This report will include details of the work performed that day (Location, quantities, equipment, personnel), quality control methods used, inspections and verifications performed and any field conditions encountered which affect the quality of the completed project. A sample of this report is included in Appendix A. This report is to be submitted via e-mail and hardcopy.

The Transport and Disposal contractor (RDC) will be required to submit weekly reports on tons disposed per container, tons disposed per day and tons disposed per week at the landfill. The report will also contain a cumulative total of tons disposed since start of project. The report will contain details on any containers shipped from the site but not received at the landfill. This report is to be submitted via e-mail and hardcopy.

9.1.2 Quality Assurance/Quality Control Reports

The CQAO will prepare weekly Quality Assurance Report and submit via e-mail to the HHCG and EPA. The weekly report will include a detailed description of construction events, as well as any delays and their causes. The report will describe the results of the CQAO quality assurance inspections, testing, surveying, and monitoring activities, and the effectiveness of the Contractor's quality control activities. Out-of-spec conditions that may have been encountered and the actions taken to correct the situation will be described in the report. Any work found not to be in accordance with the EPA-approved remedial design plans, specifications, work plan, and/or documents shall be brought to the immediate attention of the HHCG and EPA.

9.1.3 Change Orders

The contractor will submit all change orders to the HHCG and Construction Oversight Contractor (DOF) for review. All submitted change orders will include a description of the change, reason for the change, the schedule impacts of the change and cost impacts of the change. Submitted change orders will be reviewed by DOF and HHCG. DOF will review the technical details of the proposed change. If the submitted change order does not contain all information necessary for review, it will be returned to the Contractor for revision.

If the proposed change is acceptable to DOF and the HHCG, it will be submitted to EPA as a revision to the plans. The Contractor will then be notified of the acceptance of the change. If time allows, the proposed change will be submitted to EPA for approval prior to implementation.

9.2 Post Completion of Remedial Action Construction

The following reports will be prepared following completion of the 2003 Remedial Action

9.2.1 Pre-Final Construction Letter/Report

Within seven (7) days of the Prefinal construction inspection, a prefinal construction inspection letter/report will be submitted to EPA. The prefinal construction inspection report will include a summary of the major CQAP results and field changes, as well as minutes from the inspection. The prefinal inspection report will outline the outstanding construction items, actions required to resolve items, completion date for these items, and a proposed date for final inspection, and otherwise comply with Section IX of the UAO.

9.2.2 Final Construction Letter/Report

The CQAO will prepare a Final Construction Letter/Report for submittal to EPA within thirty days of the final inspection. The report will include a summary of construction events, as well as any significant delays and their causes. The report will summarize the results of the CQAO quality assurance inspections, testing, surveying, and monitoring activities, and the effectiveness of the Contractor's quality control activities. Out-of-spec conditions that may have been encountered and the actions taken to correct the situation will be summarized in the report. Any work found not to be in accordance with the EPA-approved remedial design plans, specifications, work plan, and/or documents shall be brought to the immediate attention of the HHCG and EPA. The report will include as built drawings of the project area including topographic survey data and summaries of results of confirmation sampling.

10 References

TABLE 1. Required Contractor Submittals

Construction Element	Submittal Required	From	Due
General	Certificates of Insurance	ALL CONTRACTORS	10 days after project award
Health and Safety	Site Health and Safety plan	Remedial Action Contractor	10 days after project award
	Health and Safety and Medical training records	Remedial Action Contractor	Prior to start of construction
Transport and Disposal	Workplan	Transportation and Disposal Contractor	10 days after project award
	Daily Tonnage summary	Transportation and Disposal Contractor	Daily
	Weekly Transportation and Disposal Summary	Transportation and Disposal Contractor	Weekly
Shoreline Excavations (J & G Property, GM Graving Slip, ATOFINA Shoreline) and Demolition	Work plan	Remedial Action Contractor	10 days after project award
	CQC Plan	Remedial Action Contractor	10 days after project award
	Environmental Protection Plan (EPP)	Remedial Action Contractor	10 days after project award
	Project Schedule	Remedial Action Contractor	10 days after project award, updated weekly during RA
	All contractor performed surveys	Remedial Action Contractor	Within 2 days of survey

TABLE 2. Monitoring Performed by CQAO

Construction Element	Monitoring Requirement	Monitoring Frequency
Prior to Construction	Verification and inspection of all equipment and field staking	Prior to start of construction
Transition Zone Grading	Sampling at material source, chemical and grain size analysis of material as per SSOM. Five (5) days notice will be given to EPA and ESA agencies prior to placement.	Prior to import or placement of TZGM
Demolition	Visual confirmation of structure removal	Daily during demolition phase
Shoreline Excavation	Pre RA Sediment Characterization at ATOFINA Test Pit's – Collection and analyses as per SSOM	Prior to Shoreline Excavation as per SSOM
	Confirmation Sampling of excavated surface as per SSOM	Upon completion of excavation to required grade or after additional excavation (Prior to material placement)
Material Loading and Transport	Observation of loading area for proper housekeeping, water management, Scale tickets	Daily during Disposal process

Appendix A

Example Daily Contractor Production Report

CONTRACTOR PRODUCTION REPORT

Page _____ of _____

DATE:

CONTRACT NO	Project Title: Project Location:	REPORT NO

Contractor:	Superintendent:

AM WEATHER CONDITIONS	PM WEATHER CONDITIONS	MAX. TEMP. ____ °	MIN. TEMP. ____ °

WORK PERFORMED TODAY

WORK LOCATION AND DESCRIPTION	EMPLOYER	NO.	TRADE	HRS

JOB SAFETY			
JOB SAFETY	Was a Job Safety Meeting held this date?	Yes ☐ No ☐	Total Work Hours On Job Site This Date:
	Were there any lost time accidents this date?	Yes ☐ No ☐	Cumulative Total of Previous Work Hours:
	Was Trenching / Scaffolding / Electrical Work Done?	Yes ☐ No ☐	
	Was Hazardous Material Waste released into the environment?	Yes ☐ No ☐	Total Hours From Start of Construction:

List Safety Actions Taken Today / Safety Inspection Conducted:

EQUIPMENT / RENTAL DESCRIPTION	VENDOR	P.O. #	CHARGE #	UNIT RATE	HRS	INCURED COST	
MATERIALS / SUPPLIES RECEIVED	VENDOR	P.O. #	CHARGE #	UNIT RATE	QTY REC'D	ACCUM QTY	P.O. QTY
NEW ONGOING COSTS	VENDOR	P.O. #	CHARGE #	First or Last Day	UNIT RATE		
SUB. / SERVICES DESCRIPTION	VENDOR	P.O. #	CHARGE #	F/P or L/S (type)	COST INCUR	% COMPLETE	ACCUM % COMPLETE
LAB SAMPLES	VENDOR	P.O. #	CHARGE #	UNIT RATE	# OF SAMP.	INCURED COST	

COMMENTS

CONTRACTOR PRODUCTION REPORT

Page ____ of ____

DATE:

CONTRACT NO	Project Title: Project Location:	REPORT NO
Contractor:	Superintendent:	
AM WEATHER CONDITIONS	PM WEATHER CONDITIONS	MAX. TEMP. ____ ° MIN. TEMP. ____ °

Superintendant Date

CONTINUATION IF REQUIRED:

EQUIPMENT / RENTAL DESCRIPTION	VENDOR	P.O. #	CHARGE #	UNIT RATE	HRS	INCURED COST	
MATERIALS / SUPPLIES RECEIVED	VENDOR	P.O. #	CHARGE #	UNIT RATE	QTY REC'D	ACCUM QTY	P.O. QTY
NEW ONGOING COSTS	VENDOR	P.O. #	CHARGE #	First or Last Day	UNIT RATE		
SUB. / SERVICES DESCRIPTION	VENDOR	P.O. #	CHARGE #	F/P or L/S (type)	COST INCUR	% COMPLETE	ACCUM % COMPLETE
LAB SAMPLES	VENDOR	P.O. #	CHARGE #	UNIT RATE	# OF SAMP.	INCURED COST	

COMMENTS

Superintendent Date

C - 2003 SSOM

Appendix C
2003 Sediment Sampling Operations Manual

2003 SEDIMENT SAMPLING OPERATIONS MANUAL (SSOM) INTERTIDAL REMEDIATION & UNDER-DOCK NATURAL RECOVERY

HEAD OF HYLEBOS WATERWAY PROBLEM AREA
COMMENCEMENT BAY NEARSHORE / TIDEFLATS SUPERFUND SITE
TACOMA, WASHINGTON

Prepared for Head of Hylebos Cleanup Group (HHCG)

- ATOFINA Chemicals, Inc.
- General Metals of Tacoma, Inc.

HHCG Approval

Signature ______
Paul F. Fuglevand, Project Manager

Date 5-1-03

Signature ______
Rob Webb, CQA

Date 5-1-03

Signature ______
Raleigh Farlow, Analytical QA

Date 5-1-03

EPA Approval

Signature ______
Peter Contreras, Site Manager

Date 5-7-2003

Signature ______
QA Officer

Date 5-7-2003

Dalton, Olmsted & Fuglevand, Inc. *Environmental Consultants*

Kirkland, Washington

May 1, 2003

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2003 SEDIMENT SAMPLING OPERATIONS MANUAL
Intertidal Remediation & Under-Dock Natural Recovery Areas

HEAD OF HYLEBOS WATERWAY PROBLEM AREA
COMMENCEMENT BAY NEARSHORE / TIDEFLATS SUPERFUND SITE
TACOMA, WASHINGTON

1 INTRODUCTION AND PROJECT BACKGROUND

1.1 INTRODUCTION

This Sediment Sampling Operations Manual (SSOM) presents the specific sampling and analysis procedures and equipment that will be used to perform sediment sampling for performance and compliance monitoring during intertidal remediation as part of the Construction Quality Assurance Plan (CQAP), and at natural recovery areas of the Head of Hylebos Waterway Problem Area, as part of the Operation, Maintenance and Monitoring Plan (OMMP). It is submitted by ATOFINA Chemicals, Inc. ("ATOFINA") and General Metals of Tacoma, Inc. ("General Metals"), collectively referred to in this work plan as Head of Hylebos Cleanup Group ("HHCG").

The contents of this SSOM will periodically be reviewed by the HHCG. If appropriate, the HHCG will recommend updates to the plan that reflect changes in Hylebos-specific or standard analytical or sampling procedures, applicable EPA policy, or laboratory Standard Operating Procedures.

The SSOM adopts the existing EPA-approved health and safety plan for sampling (HSP) and Quality Assurance Project Plan ("HCC-QAPP")[1], and provides updates and modifications as appropriate to reflect the specific nature of the sampling (see Attachment A).

1.2 PROJECT DESCRIPTION

The Head of Hylebos project is located at the eastern end of the Hylebos Waterway, part of the Commencement Bay Nearshore / Tideflats (CB/NT) Superfund site (see Figure 1-1, Vicinity Map). The Head of Hylebos cleanup plan addresses all of the sediment

[1] Combined Sampling and Analysis Plan, Quality Assurance Project Plan, and Health and Safety Plan, Commencement Bay Nearshore/ Tideflats Superfund Site. Hylebos Waterway Problem Areas. Striplin Environmental Associates, Inc. February 22, 1994.

remedial action areas and natural recovery areas identified at the Head of Hylebos Waterway in the U.S. Environmental Protection Agency, Region 10 ("EPA") August 2000 Explanation of Significant Differences ("2000 ESD") (see Figure 1-2) that have not been remediated or included in other EPA or State approved cleanup plans.

The Head of Hylebos project is based on a sequence of activities that starts with land-based excavation of the shoreline and marine demolition in 2003, followed by marine dredging and transition zone grading in 2004. The cleanup project is split between the 2003 and 2004 construction seasons as follows:

2003 Activities

- Intertidal Remediation
- Demolition and Bank Cleanup
- Partial Hylebos Marina Relocation

2004 Activities

- Structure Removal and Replacement
- Dredging
- Transition Zone Grading
- Hylebos Marina Dredging and Reconfiguration

This 2003 Intertidal Remediation SSOM is intended to specifically address the intertidal remediation activities for the project. The 2003 intertidal remediation actions are located at the following properties:

- ATOFINA Intertidal Area of SMA 221 (see Figure S-5)
- Dunlop Log Haul out, SMA 242 (See Figure S-6)
- General Metals Graving Slip, SMA 203 (see Figure S-7)
- J&G Boat Haul out, SMA 142 (see Figure S-8)

Intertidal remediation addresses the portions of the site located between elevations 0 and +12' MLLW.

As part of the habitat conservation measures for the project, the intertidal remediation will occur using upland-based equipment (excavators, dozers, dump trucks) after the tides are out so that the excavations are completed out of the water. That way there will be no in-water work associated with the intertidal remediation. For worker safety reasons, this approach requires that the excavations occur during daylight periods of very low tides that reach at least –2' MLLW, to allow for sufficient work time down to and including the 0' MLLW contour. After August 12, there is not another daylight very low tide of –2' MLLW until March 2004. Consequently the intertidal excavations are scheduled to start on June 12, 2003, and continue through last eighteen days of daylight very low tides in 2003, as follows:

- June 12-17, 2003: -2.1' to –3.9' (6 days)
- June 30 – July 2, 2003: -2.0' - -2.2' (2 days)
- July 11-15, 2003: -2.6' to -3.5' (5 days)
- July 29: -2.0 ft. (1 day)
- August 9-12: -2 ft to -2.4 ft. (4 days)

1.3 PROJECT ORGANIZATION

The SSOM team consists of companies and individuals with extensive experience at Hylebos Waterway, as well as sediment dredging projects. Dalton, Olmsted & Fuglevand, Inc. (DOF) is the prime design contractor, supported by DMD, Inc. (DMD) for data validation.

The SSOM technical team is organized as follows:

Project Management / Project Coordinator: The project manager is responsible to HHCG for the technical implementation of the work plan, coordination of the technical team, and will act as the Project Coordinator with EPA for HHCG. Paul Fuglevand (DOF) is the designated project manager / project coordinator for the project. He has been project coordinator for the pre-remedial design (Hylebos Cleanup Committee) since 1993. He is responsible for the following tasks:

- Project Management
- Project Coordination with EPA
- Work Plan Preparation
- Submission of Progress Reports

Construction Quality Assurance. The CQAO is responsible to the Project Manager, and will conduct sufficient inspections, independent sampling and testing, and monitoring activities to assure that the terms and conditions of the contract are being complied with. The CQAO will also be responsible for overseeing the collection of sediment/water data for design and monitoring, preparation of SAP/QAPP/HSP plans, and preparation of sampling and monitoring data reports. Rob Webb of DOF is the designated CQAO for the project. Responsibilities of the CQAO include, but are not limited to, the following:

- Monitoring quality control activities to ensure conformance with authorized policies, procedures, and sound construction practices, as well as recommending improvements, as necessary

- Coordinating the activities and conducting meetings with site personnel covering the requirements of the construction quality control procedures and CQAP, as appropriate to insure project success

- Performing inspections and surveillances of the construction team and its subcontractors' project activities to ensure that project procedures are being followed and project objectives achieved

- Identifying, and resolving nonconformance's in accordance with the requirements of the construction quality control procedures and CQAP

- Monitoring corrective action documentation for conditions adverse to quality, verifying implementation of corrective actions, tracking and analyzing corrective action, and providing closeout corrective action documentation upon completion.

- Specific sampling activities including
  - Sampling Plans
  - Performance Monitoring
  - Long-Term Monitoring
  - Sediment Sampling and Analysis
  - Data Evaluation
  - Report Preparation
  - Analytical Laboratory Oversight
  - Data Validation and Evaluation
  - Report Preparation

Analytical Quality Assurance. The designated Analytical QA is Raleigh Farlow of DMD. He is responsible to the CQAO and will be responsible for:
- Analytical portions of the QAPP
- Analytical Laboratory Oversight
- Data Validation and Evaluation
- Report Preparation

1.4 CONTACT INFORMATION FOR KEY PERSONNEL

The contact information for key personnel is provided below.

Name Company Responsibility	Address	Phone Numbers V = voice. F = fax M = mobile	email
Fred Wolf	Fred Wolf	V 253 627-9101	Fredrick.wolf@atofina.com

ATOFINA HHCG Rep.	ATOFINA Chemicals 2901 Taylor Way Tacoma, WA 98421-4330	Ext 10 F 253 627-0554	
Mat Cusma General Metals HHCG Rep.	Mat Cusma General Metals of Tacoma P.O. Box 10047 Portland, OR 97201	V 503 286-6944 F 503 286-6948 M 503 209-6057	mcusma@schn.com
Paul Fuglevand DOF Proj. Coordinator	Paul Fuglevand Dalton, Olmsted & Fuglevand, 10827 NE 68th St. Kirkland, WA 98033	V 425 827-4588 F 425 739-9885 M 206 660-3079	pfuglevand@dofnw.com
Rob Webb DOF CQAO	Rob Webb Dalton, Olmsted & Fuglevand 10705 Silverdale Way NW Suite 201 Silverdale, WA 98383	V 360-692-7345 F 360-692-1895 M 360-908-1080	rwebb@dofnw.com
Raleigh Farlow DMD Analytical QA	Raleigh Farlow D.M.D. Inc. 13706 SW Caster Road Vashon, WA 98070	V 206 463-6223 F 206 463-4013	dmdinc@telisphere.com

1.5 DISTRIBUTION LIST FOR 2003 SSOM

The 2003 SSOM distribution list is as follows:

- Fred Wolf, ATOFINA for HHCG
- Mat Cusma, General Metals for HHCG
- Paul Fuglevand, DOF for HHCG
- Rob Webb, DOF for HHCG – copy to be kept a field office
- Raleigh Farlow, DMD for HHCG
- Analytical laboratory
- Peter Contreras, EPA
- Paul Johanson, URS for EPA
- Beth Coffey, USACE
- Russ McMillan, Washington Department of Ecology
- Robert Taylor, NOAA Damage and Restoration Center.

2 DATA QUALITY OBJECTIVES

The data quality objectives for the post-removal site control sediment sampling are consistent with the objectives presented in Section 7 of the HCC Sampling and Analysis Plan (HCC, 1994).

The specific sampling procedures are discussed in Section 3. Analytical methods used are discussed in Section 4. Laboratory QA/QC procedures are discussed in Section 5.

3 SAMPLING PROGRAM

This section describes the sampling locations, frequencies, procedures, and equipment that will be used for the OMMP sampling program. Field personnel will be provided copies of the SSOM prior to implementing the field sampling. Field sampling protocols will be performed consistent with the HCC SAP (HCC, 1994) and the *Recommended Guidelines for Sampling Marine Sediment, Water Column, and Tissue in Puget Sound* (PSEP, 1997a).

3.1 SAMPLE LOCATIONS

3.1.1 Intertidal Characterization Samples

The original Pre-Remedial Design intertidal sampling for Hylebos Waterway subdivided the shoreline into reaches of similar ownership and upland activities. The intertidal sampling areas were typically on the order of a couple hundred feet in length, ranging from 50 to 1,000 feet in length. Multiple samples were collected from within each shoreline area and composited for testing.

Prior to initiation of cleanup, the following intertidal cleanup areas will be resampled to refine the extent of the intertidal area requiring cleanup:

- ATOFINA Intertidal Dock (SMA 231) Figure S-1

For the purpose of sampling, each of the intertidal remediation areas is divided into specific Intertidal Sampling Areas no larger than 5,000 square feet. Consistent with the 1B SAP, each Intertidal Sampling Area is subdivided into 50-ft. long sub-areas. A surface core will be collected from roughly the center of each sub-area for testing, as summarized on Table S-1.

Each discrete sample will be analyzed for the target parameters referenced on Table S-1, as discussed in Section 4.1 of the SSOM.

3.1.2 ATOFINA Shoreline Test Pits

Test pits will be completed along the ATOFINA shoreline, as shown on Figures S-1 and S-2, prior to the bank cleanup actions to better characterize the nature of debris in the material to be excavated. Large debris, such as brick and broken concrete will be removed from the excavated material prior to relocating it on the ATOFINA property. The test pits will aid in the planning for material processing and handling.

3.1.3 Sediment Samples for Natural Recovery Monitoring

Each discrete natural recovery area will be classified as a single sampling location. Each sampling location will be subdivided into 5,000 square foot sub-areas (50ft. by 100ft. for example). A 10-centimeter deep sample will be collected from each of the sub-areas and composited into a single sample representing the natural recovery location.

The sampling location for the Weyerhaeuser natural recovery area SMA 102 is presented on Figure S-4. The sample will be analyzed for the target parameters presented on Table S-8.

3.1.4 Intertidal Remediation Confirmation Sampling

The remediation process will focus on removal of intertidal Recent sediment that typically contains anthropogenic material (such as debris or sand blast grit) and is visually distinct from the underlying Native sediment. Once such material has been removed from an area, based on visual observations, then confirmation monitoring data will be collected, as detailed below.

The confirmation sampling program for the 2003 Intertidal Remediation is based on the methods presented in the Hylebos Cleanup Committee (HCC) document titled Sediment Sampling for Event 1B ("1B SAP"), which was developed for the investigation of the Intertidal areas of the Hylebos Waterway. The intertidal sampling completed under the SSOM will use the same sampling equipment (hand-held cores), will sample the same depth (10 cm) of sediment, and use the same analytical methods as the Event 1B Intertidal program.

For the purpose of sampling, each of the intertidal remediation areas is divided into specific Intertidal Sampling Areas no larger than 5,000 square feet, as shown on Figures S-3 through S-6, attached Consistent with the 1B SAP, each Intertidal Sampling Area is subdivided into 50-ft. long sub-areas. A surface core will be collected from roughly the center of each sub-area, with all cores from an Intertidal Sampling Area composited into one sample for testing, as summarized on Table S-2.

3.1.5 Import Material Characterization

The Transition Zone Grading Material and Quarry Spalls will be collected from the source location for characterization and acceptance prior to import to the site. A 10-

gallon sample of material will be collected from each source location. Each sample will be composited with no less than five sub-samples taken throughout the source, and shall be representative of the material observed at the source. The collected samples will be submitted for analytical testing as described in Section 4, and for physical testing as follows:

Physical Testing

- Specific gravity of solids (ASTM D-854)
- Water content (ASTM D-2216)
- Grain Size Distribution (ASTM D-422-63 – Wet Sieve)

3.2 SAMPLING LOGISTICS

3.2.1 Notification

EPA's site manager will be notified five days before each sampling event to provide EPA with an opportunity to schedule oversight of the work.

3.2.2 Sampling Vessels

Intertidal sediment sampling will be conducted when the tides are out so the locations can be approached from the adjacent upland. Sample processing will occur at the site.

Subtidal sampling under docks will be conducted from a small boat capable of movement under the docks. The small boat will transport the field crew from a base station on the R/V Point Defiance, or at a shore location, to the sampling location for collection of the samples. The field crew will return with the sediment samples to the base station where processing for chemical testing will occur.

3.2.3 Station Positioning Procedure

Intertidal sediment sampling will either use differential global positioning or taping from existing site features to locate sampling stations. Under-dock sampling will use taping from existing site features to locate sampling stations. The precision of the positioning system will be +/- 1 to 3 meters, consistent with the HCC SAP (HCC, 1994).

3.2.4 Field Personnel

The field crew will consist of a leader and one staff; one of the two people will also serve as the site safety officer. The responsibilities of these individuals will be consistent with those stated in the HCC SAP, Section 6.3.2 (HCC, 1994).

3.2.5 Field Logbook

The field logbook will be a bound document containing individual field and sample log forms. Information will include personnel, date, time, station designation, sampler, type of sample collected, and general observations.

3.2.6 Equipment and Supplies

During mobilization, all required field equipment and supplies will be loaded onto the sampling vessel. Equipment and supplies will include, in general, sampling equipment (e.g., positioning equipment, samplers, core tubes, stainless steel spoons, and sieve boxes), utensils, decontamination supplies, sample containers, coolers, logbooks, personal protection equipment, and personal gear.

3.2.7 Equipment Decontamination Procedures

Decontamination procedures will follow those listed in Section 6.4.2 of the HCC SAP (HCC, 1994).

Decontamination of stainless steel bowls, utensils, core catcher, and the intertidal sample corers or spoons or other sampling equipment will be performed before sampling and between each composite sample. Decontamination will occur in the following manner[2]:

- Rinse with water provided by the sampling vessel
- Wash with brush and Alconox™ soap
- Double rinse with distilled water
- Rinse with deionized water

Sample handling equipment will also be wrapped in aluminum foil, with the dull side facing the equipment, following the methanol rinse. Before being used to remove sediment from the samplers, all equipment will be rinsed with deionized water. Rinse water will be diluted with site water and discarded into the waterway.

Sample containers and glassware will be prepared consistent with the requirements of PSEP guidelines (PSEP, 1997c).

3.2.8 Sample Collection and Processing

3.2.8.1 Logistics

The field crew will use either the R/V Point Defiance, or an upland location, for sample processing. The sample processing station will be used to decontaminate sample

[2] A methanol rinse will be added if an organic residue is encountered that is not responsive to the Alconox wash.

collection and handling equipment, and homogenize and distribute sample material to collection jars.

3.2.8.2 Sample Collection

Sample collection is described separately for intertidal samples, under-dock samples, and test pits. Samples which are found to contain recent material or other obvious indications of contamination (visual, olfactory, or sheens) will not be mixed with samples of native material for composite analysis. Areas with samples exhibiting such characteristics will either be subject to additional removal or discrete sample analysis.

Intertidal Samples

The intertidal sampling procedure will follow the methodology presented in Section 6.4.3.4 of the HCC SAP (HCC, 1994), titled Intertidal Sample Collection and Processing.

The samples will be obtained by a hand-held coring device. A stainless steel sampling device is used to collect the sediment samples Sample collection procedures for this type of device are described as follows. A valve on top of the device must be opened to allow air and water to escape, thereby preventing compression of the sediment surface. The device must be gently pushed into the sediment to the 10-centimeter mark, using a twisting motion to facilitate penetration. Care must be taken to ensure that the sediment surface does not come into contact with the top of the sampler. The retention plate must then be placed into its slot to prevent the sediment from falling out of the corer, and the valve closed. The corer must then be slowly extracted from the sediment for processing.

Prior to processing, the following acceptability criteria must be met:

- The coring device penetrated to the minimum acceptable penetration depth
- At least 10 centimeters of sediment is present in the coring device.

After each sample is accepted, it will be described in the field log. Qualitative characteristics of the sample will be recorded.

Sediment from multiple cores will be composited into stainless steel mixing bowls for chemical testing. An equal amount of sediment will be collected at each subsample location. The bowls will be covered with aluminum foil and transported to the sample processing station when they are full.

Under-Dock Samples

Under-dock samples, such as for the Weyerhaeuser natural recovery area (SMA 102), will be collected from a small boat capable of movement under the dock. The top 10 cm

of sediment will be collected using a hand-deployed stainless steel coring device, such as an AMS Sludge Sampler which is two to three inches in diameter by twelve inches in length with a core catcher for retention of soft sediment. It can be deployed to the bottom on either a cord or a rod depending on the site conditions.
Prior to processing, the following acceptability criteria must be met:

- The coring device penetrated to the minimum acceptable penetration depth
- At least 10 centimeters of sediment is present in the coring device.

After each sample is accepted, it will be described in the field log. Qualitative characteristics of the sample will be recorded.

Sediment will be composited into stainless steel mixing bowls for chemical testing. An equal amount of sediment will be collected at each subsample location. The bowls will be covered with aluminum foil and transported to the sample processing station when they are full.

Test Pits

Test pits are planned along the ATOFINA shoreline to better characterize the nature of material to be excavated, with a primary focus on the nature of debris. The excavations will be advanced by the remediation contractor utilizing the excavator equipment mobilized to the site for the cleanup, and will extend to the depth of excavation indicated on the cross sections of the project drawings.

The materials exposed in the walls and floor of each test pit will be described in a field log. The nature and extent of exposed debris will be qualitatively described, along with the grain-size characteristics of the soil matrix.

Two soil samples will be collected from the test pits along the ATOFINA shoreline shown on Figure S-1 from the material that will be exposed at roughly elevation 5' and 10' MLLW by the bank cleanup and intertidal remediation process. One sample will be collected from the ATOFINA test pits shown on Figure S-2 at the elevation exposed by the bank cleanup process. The samples will be submitted for analytical testing of the parameters indicated on Table S-3a.

3.2.8.3 Sample Processing

Sample processing will be consistent with the methods described in Section 6.4.3 of the HCC SAP (HCC, 1994). Piston samples will be processed as follows:

- A label identifying the station and sample will be securely attached to the top of the tube, and wrapped with transparent film or tape to prevent loss or damage of the label.
- Sediment at the tip of the tube will be visually classified as either Recent (soft black muck), or Native sediment, or Residual (mixture of Native and Recent).
- The length of sample within the core will be established by measuring the length of the void space in the top of the core, and subtracting that length from the full length of the tube. An acceptable sample should contain at least 6-inches of material.
- Tubes will be extruded by use of a core press, or by vibrating the core tube, or by elevating the tube at an angle and gently tapping the tube. The extruded sediment will be collected into a stainless steel trough.
- The extruded sample will be visually classified prior to compositing and the following information will be recorded:
  - Sample location
  - Sampling date and time
  - Elevation of bed at sample location
  - Recovered sample length
  - Physical soil description (soil type and color, stratification)
  - Other distinguishing characteristics or features
- The top 10 centimeters of the core will be collected for chemical testing, or for inclusion into a composite of several samples for chemical testing.

Once all sediments from a station are at the sample processing station, the sample will be thoroughly homogenized and distributed to sample containers. Organisms and debris will be removed prior to distribution to sample containers; removed materials will be noted in the field logbooks.

All sample containers will be labeled on the outside in indelible ink with the sample identification number, date collected, and analysis to be performed.

Sample containers, preservation methods, and holding times for sediment samples will be the same as specified in Table 9 of the HCC SAP (HCC, 1994).

3.3 CHAIN OF CUSTODY PROCEDURES

The samples collected will follow the chain of custody procedures provided in Section 6.5 of the HCC SAP (HCC, 1994). The field crew will be given photocopies of these procedures prior to initiating the fieldwork.

3.4 SAMPLING HANDLING AND TRANSPORT PROCEDURES

The sample handling and transport procedures will follow the procedures provided in Section 6.6 of the HCC SAP (HCC, 1994). The field crew will be given photocopies of these procedures prior to initiating the field work.

3.5 QUALITY CONTROL AUDIT FOR FIELD SAMPLING

Given the limited extent of sediment sampling, no performance audit of the field sampling procedures will be conducted.

4 SEDIMENT SAMPLE CHEMICAL ANALYSES

In accordance with the requirements of this project, the analytical laboratory methods and associated quality assurance and quality control (QA/QC) procedures were established based on the protocols used by the HCC (HCC, 1994).

All sediment chemical analysis will be performed by Analytical Resources, Inc. (ARI) of Tukwila, Washington, or Columbia Analytical Services (CAS) of Kelso, Washington.

4.1 ANALYTICAL METHODS AND DETECTION LIMITS

The Target Parameter list for the intertidal remediation areas and natural recovery areas are those compounds shown by the Pre-Remedial Design (Figure 2-1 of the 2003 RA Work Plan) to exceed the SQO chemical criteria within the specified area, as well as some additional parameters requested by Ecology. As summarized in Attachment B, the normal analysis for the Pre-Remedial Design samples shown on Figure 2-1 was the full Sediment Quality Objective (SQO) list. Specific target parameter lists for each of the identified intertidal remediation areas are presented on Tables S-3, a through d, with target parameters for the natural recovery area on Table S-3e. The target parameter list for import materials (Transition Zone Grading Materials and Quarry Spalls) shall be the CB/NT SQO list, Table S-4, attached.

The analytical procedures will follow the protocols specified in Section 7.1.2 of the HCC SAP (HCC, 1994). Table 6 of the HCC SAP summarizes the analytical methods and reporting limits for the various target parameters.

4.2 LABORATORY QC REQUIREMENTS

Laboratory QC requirements will follow the protocols specified in Section 7.1.2 of the HCC SAP (HCC, 1994).

5 QA/QC PROCEDURES

5.1 DOCUMENTATION

Field notes detailing the sampling activities will be maintained by the field sampling personnel. In particular, notes and sketches will be used to document the location and condition of each sediment sample collected.

5.2 DATA QUALITY ASSESSMENT

5.2.1 Quality Assurance Objectives

The quality assurance objectives for the HHCG post-removal site control sampling program are as follows:

- Establish sampling techniques so that the analytical results are representative of the media and conditions being measured
- Analyze a sufficient number of laboratory duplicate samples to assess the laboratory analysis precision and sample heterogeneities.
- Analyze method blanks and spikes to evaluate results and check the results against laboratory QA control limits established for analytical representativeness and accuracy.

Data quality will be assessed in terms of representativeness, comparability, precision, accuracy, and completeness. These criteria are discussed below.

5.2.2 Data Quality Assessment

5.2.2.1 Representativeness

Representativeness will be accomplished by:

- Choosing sampling procedures that produce results that depict as accurately and precisely as possible the matrix and conditions being measured.
- Developing protocols for storage, preservation, and transportation that preserve the integrities of the collected samples.

- Using documentation procedures that ensure samples have been properly identified so that their integrities are maintained.

Laboratory sample handling, storage, and documentation procedures will be consistent with the HCC SAP (HCC, 1994). Laboratory method or preparation blanks, used to assess the level of laboratory background contamination, will be analyzed for every analytical batch of twenty samples or less.

5.2.2.2 Comparability

Data developed during sampling should be either directly comparable or comparable within defined limitations to literature, existing data, or any applicable criteria (such as SQOs or applicable action levels from final remedial measures for the Hylebos Waterway). *Comparability* of the data will be maintained by using EPA-recommended procedures for sampling activities and analytical methods.

5.2.2.3 Precision

Analysis of laboratory duplicate samples will evaluate the *precision* of laboratory procedures. Laboratory duplicates will be analyzed at a frequency of 5 percent, or a minimum of once per analytical batch in accordance with method requirements and laboratory SOPs. Acceptability criteria for the laboratory duplicate results will be based on the laboratory-specific control limits.

Because of the limited nature of the sediment sampling, field duplicate samples will not be collected.

5.2.2.4 Accuracy

Accuracy is a measure of the error between reported test results and the true sample concentration. Because true sample concentrations are not known, accuracy is usually inferred from recovery data, as determined by sample spiking.

For Aroclor and SVOC (incl. PAH) analyses, every sample will be spiked with surrogate compounds and selected samples will be spiked in duplicate with selected target compound list (TCL) analytes (list found in HCC, 1994) known as matrix spike/matrix spike duplicates (MS/MSDs). Acceptable accuracies for the parameters of interest and analysis methods specified in the SAP will be based on the control limits described in the HCC SAP. Matrix spikes or MS/MSDs will be analyzed at a frequency of 5 percent, or a minimum of once per analytical batch of ten to twenty samples. For batch sizes less than 10 samples, MS/MSD (or MS and duplicates in the case of inorganics) analyses will be performed once for every 20 samples. Accuracy will be assessed using surrogate recoveries, in the case of organics, and lab-provided independent reference materials for inorganics for individual batches of less than 10 samples.

5.2.2.5 Completeness

Completeness is the total number of samples taken for which acceptable analytical data are generated, divided by the total number of samples analyzed and multiplied by 100. An overall completeness goal for this project is 90%..

A summary of estimated numbers of field and QC samples is presented on Table S-5.

5.3 LABORATORY DATA REPORTS AND DATA REDUCTION

The analytical laboratory will provide data packages reporting the sample results and the results of the laboratory QA/QC measurements. The laboratories will maintain complete raw data records of the analyses in their files sufficient to allow independent validation of the results.

Analytical data collected during the sampling and analysis program will be entered into a computer spreadsheet program database. All entries will be verified.

5.4 DATA REVIEW

A QA/QC review of the data for the sediment samples will be performed once the data is received from the analytical laboratory. This review will include the following:

- Chain-of-custody complete and correct.
- Analysis within holding times and conditions.
- Chemicals of concern in method blanks.
- Blank spike recoveries within accuracy control limits.
- Blank spike duplicate results within analytical precision control limits.
- Surrogate recoveries within accuracy control limits.
- Matrix spike recoveries within accuracy control limits.
- Matrix spike duplicate results within analytical precision control limits.
- Detection limits sufficiently low.

The analytical quality control criteria for precision and accuracy in sediments will be the same as specified in Table 15 of the HCC SAP (HCC, 1994). On the basis of the results of the QA/QC data review, the data will be flagged according to standard EPA procedures as identified in the *U.S. EPA Functional Guidelines for Data Review*.

Upon completion of the review, a QA/QC memorandum will be prepared describing the usability and limitations of the analytical data in terms of the QA/QC acceptance criteria. The memorandum will be included in the sampling report for each sediment sampling event.

6 REFERENCES

Bridgewater Group, Inc. March 28, 2000. Sediment Post-Removal Site Control Plan, Schnitzer Steel Industries.

Hylebos Cleanup Committee (HCC). 1994. Combined Sampling and Analysis Plan and Quality Assurance Project Plan for the Commencement Bay Nearshore/Tideflats Superfund Site – Hylebos Waterway Problem Areas.

Puget Sound Estuary Program (PSEP). 1986. Recommended Protocols for Measuring Selected Environmental Variables in Puget Sound. Final Report. TC-3991-04. Prepared for EPA, Region 10, Seattle, Washington. Tetra Tech, Inc., Bellevue, WA.

Puget Sound Estuary Program (PSEP). 1997a. Recommended Guidelines for Sampling Marine Sediment, Water Column, and Tissue in Puget Sound. Prepared for EPA Region 10, Seattle, Washington. Puget Sound Water Quality Action Team, Olympia, WA.

Puget Sound Estuary Program (PSEP). 1997b. Recommended Quality Assurance and Quality Control Guidelines for the Collection of Environmental Data in Puget Sound. Prepared for EPA Region 10, Seattle, Washington. Puget Sound Water Quality Action Team, Olympia, WA.

Puget Sound Estuary Program (PSEP). 1997c. Recommended Guidelines for Measuring Organic Compounds in Puget Sound Water, Sediment and Tissue Samples. Prepared for EPA Region 10, Seattle, Washington. Puget Sound Water Quality Action Team, Olympia, WA.

US EPA Region 10. October 13, 1998. Administrative Order on Consent: CERCLA Docket No. 10-98-0133.

Table S-1 Intertidal Characterization Sampling Areas and Natural Recovery Sampling Areas, Head of Hylebos Waterway

Sampling Area	Location & Figure No.	Test Pit No.	Discrete Sample No	Target Compounds
CAD1	ATOFINA Dock		S1	Table S-3.a
"	Figure S-1		S2	
CAD2			S3	
"			S4	
CAD3			S5	
"			S6	
CAD4			S7	
CAD5			S8	
"			S9	
CAD5	ATOFINA East Shoreline Test Pits	T1	T1a	Table S-3.a
"	Figure S-1		T1b	
CAS1		T2	T2a	
"			T2b	
CAS2		T3	T3a	
"			T3b	
CAS3		T4	T4a	
"			T4b	
CAS4		T5	T5a	
"			T5b	
CAS5		T6	T6a	
"			T6b	
CAS6	ATOFINA West Shoreline Test Pits	T7	T7a	Table S-3.a
CAS7	Figure S-2	T8	T8a	
CAS8		T9	T9a	
CAS9		T10	T10a	
CAS10		T11	T11a	
CAS11		T12	T12a	
CAS13		T13	T13a	
NRW-1	Weyerhaeuser, Figure S-3 (natural recovery)		NR-1	Table s-3.e

Table S-2 Intertidal Confirmation Sampling Areas, Head of Hylebos Waterway

Intertidal Sampling Area	Location & Figure No.	Discrete Samples	Composite Sample No.	Target Compounds
IAD1	ATOFINA Dock	2	C1	Table S-3.a
IAD2	Figure S-4	2	C2	"
IAD3		2	C3	"
IAD4		3	C4	"
IAS1	ATOFINA Shoreline	3	C5	Table S-3.a
IAS2	Figure S-4	3	C6	"
IAS3		3	C7	"
IAS4		3	C8	"
IAS5		3	C9	"
IDH1	Dunlap Log Haulout	3	C10	Table S-3.b
IDH2	Figure S-5	2	C11	"
IDH3		2	C12	"
IGS1	General Metals Graving Slip	2	C13	Table S-3.c
IGS2	Figure S-6	2	C14	"
IGS3		2	C15	"
IGS4		2	C16	"
IJG1	J&G Marine	2	C17	Table S-3.d
IJG2	Figure S-7	2	C18	"
IJG3		2	C19	"

Table S-3 Target Parameters by Area

SMA	a. ATOFINA 221, 231	b. DUNLAP 242	c. GENERAL METALS 203	d. J&G 142	e. WEYERHAEUSER 102
Metals:					
Arsenic	X	X	X	X	
Copper	X			X	
Mercury	X		X		
Nickel	X				
Silver					
Zinc	X				
Aromatic Hydrocarbons					
total LPAH	X				
Acenaphthene	X				X
Fluorene	X				X
Phenanthrene	X				
Anthracene	X				X
2-Methylnaphthalene	X				
total HPAH	X				X
Fluoranthene	X				
Pyrene	X				X
Benz[a]anthracene	X				X
Chrysene	X				X
total Benzofluoranthenes	X				X
Benzo[a]pyrene	X				X
Indeno[1,2,3-c,d]pyrene	X				
Dibenzo[a,h]anthracene	X				X
Benzo[g,h,i]perylene	X				
Chlorinated Benzenes					
1,2,4-Trichlorobenzene					
Hexachlorobenzene	X				
Miscellaneous					
bis(2-Ethylhexyl)phthalate			X		
Dimethylphthalate				X	
Dibenzofuran	X				
Hexachlorobutadiene	X				
Pesticides					
p,p'-DDE	X				
p,p'-DDD	X				
p,p'-DDT	X				
PCBs					
Aroclors **(dry wgt - ug/kg)**	X		X		
Volatile Organic Compounds:					
Trichloroethene	X				
Tetrachloroethene	X				
Ethylbenzene	X				
total Xylenes	X				

Table S-4. Sediment Quality Objectives (SQOs).

Chemical	Sediment Quality Objective[a]
METALS (mg/kg, dry weight)	
Antimony	150 [B]
Arsenic	57 [B]
Cadmium	5.1 [B]
Copper	390 [L]
Lead	450 [B]
Mercury	0.59 [L]
Nickel	140 [A, B]
Silver	6.1 [A]
Zinc	410 [B]
ORGANIC COMPOUNDS (μg/kg, dry weight)	
Low Molecular Weight Polycyclic Aromatic Hydrocarbons (LPAH)	5,200 [L]
Naphthalene	2,100 [L]
Acenaphthylene	1,300 [A, B]
Acenaphthene	500 [L]
Fluorene	540 [L]
Phenanthrene	1,500 [L]
Anthracene	960 [L]
2-Methylnaphthalene	670 [L]
High Molecular Weight PAH (HPAH)	17,000 [L]
Fluoranthene	2,500 [L]
Pyrene	3,300 [L]
Benzo(a)anthracene	1,600 [L]
Chrysene	2,800 [L]
Benzo(b+k)fluoranthenes	3,600 [L]
Benzo(a)pyrene	1,600 [L]
Indeno(1,2,3-cd)pyrene	690 [L]
Dibenzo(a,h)anthracene	230 [L]
Benzo(g,h,i)perylene	720 [L]
Chlorinated Organic Compounds	
1,3-Dichlorobenzene	170 [A, L, B]
1,4-Dichlorobenzene	110 [B]
1,2-Dichlorobenzene	50 [L, B]
1,2,4-Trichlorobenzene	51 [A]
Hexachlorobenzene	22 [B]
Total Polychlorinated Biphenyls (PCBs)	300*
Phthalates	
Dimethylphthalate	160 [L]
Diethylphthalate	200 [B]
Di-n-butylphthalate	1,400 [A, L]
Butylbenzylphthalate	900 [A, B]
bis(2-Ethylhexyl)phthalate	1,300 [B]
Di-n-octylphthalate	6,200 [B]

Table S-4. Sediment Quality Objectives, continued.

Chemical	Sediment Quality Objective[a]
Phenols	
Phenol	420[L]
2-Methylphenol	63[A, L]
4-Methylphenol	670[L]
2,4-Dimethylphenol	29[L]
Pentachlorophenol	360[A]
Miscellaneous Extractable Compounds	
Benzyl alcohol	73[L]
Benzoic acid	650[L, B]
Dibenzofuran	540[L]
Hexachlorobutadiene	11[B]
N-Nitrosodiphenylamine	28[B]
Volatile Organic Compounds	
Tetrachloroethene	57[B]
Ethylbenzene	10[B]
Total xylenes	40[B]
Pesticides	
p, p'-DDE	9[B]
p,p'-DDD	16[B]
p,p'-DDT	34[B]

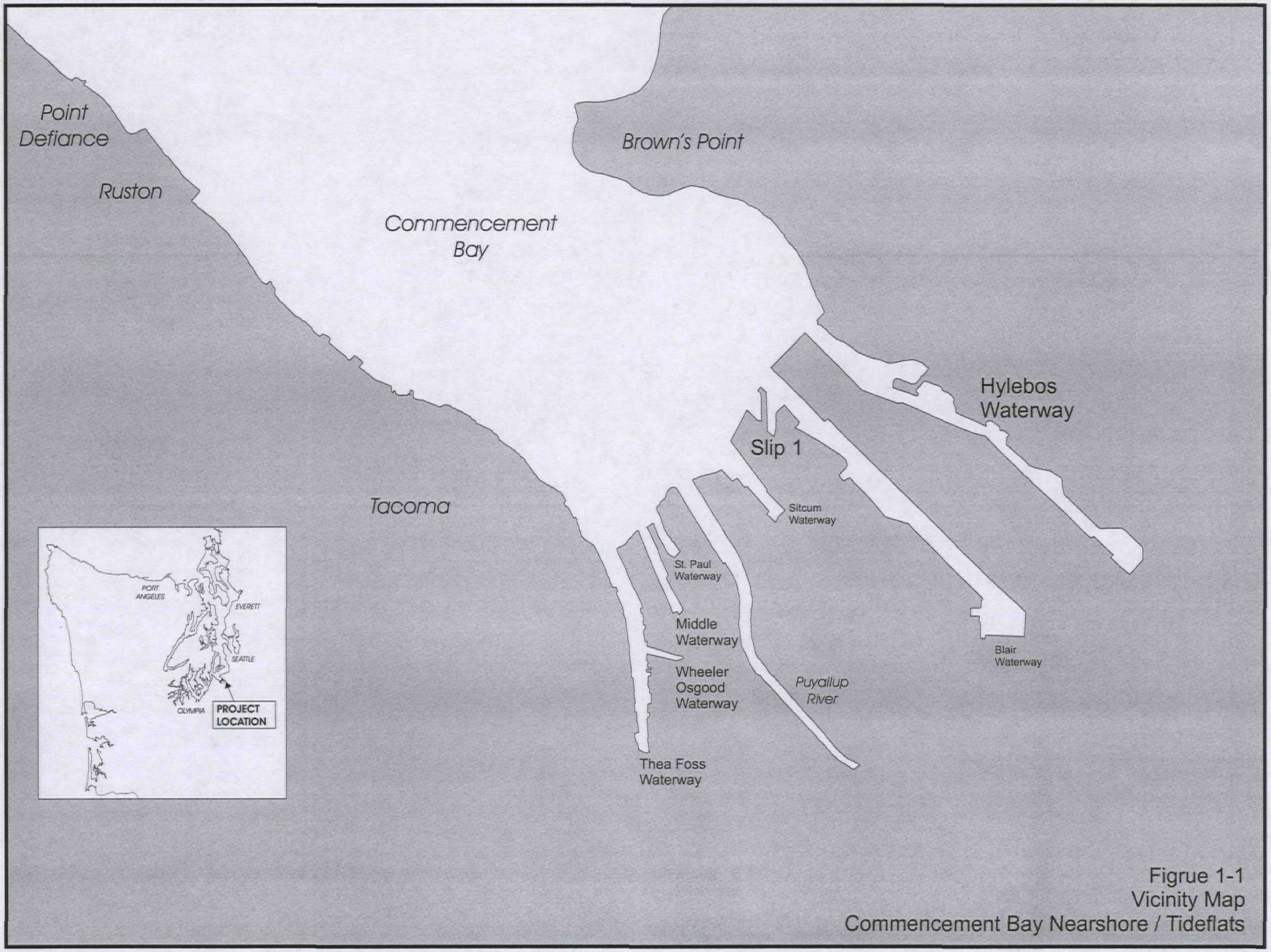
[a] Lowest apparent effects threshold among amphipod, oyster, and benthic infauna:
[A] amphipod mortality bioassay
[L] oyster larvae abnormality bioassay
[B] benthic infauna

*EPA's revised PCBs SQO (EPA 1997). The revised PCBs criterion is based on an assessment of potential effects of sediment PCBs on human health via consumption of seafood.

Table S-5. Summary of estimated numbers of field and field-generated QC samples.

Parameter	# of field samples	Rinsate Blanks	MS/MSDs	Estimated Total # of Samples
Intertidal Characterization and Source Material Characterization (Sediment Matrix):				
Metals (incl. Hg)	30	2	2	34
SVOCs (ABNs)	30	2	4	36
VOCs	30	2	4	36
Chlorinated Pesticides (DDTs)	30	2	4	36
PCBs (as Aroclors)	30	2	4	36
Intertidal Composites Confirmation (Sediment Matrix):				
Metals (incl. Hg)	19	1	1	21
SVOCs (ABNs)	17	1	2	20
VOCs	9	1	2	12
Chlorinated Pesticides (DDTs)	9	1	2	12
PCBs (as Aroclors)	13	1	2	16

All other laboratory internal QC will be performed in accordance with method requirements and laboratory SOPs.



Figrue 1-1
Vicinity Map
Commencement Bay Nearshore / Tideflats

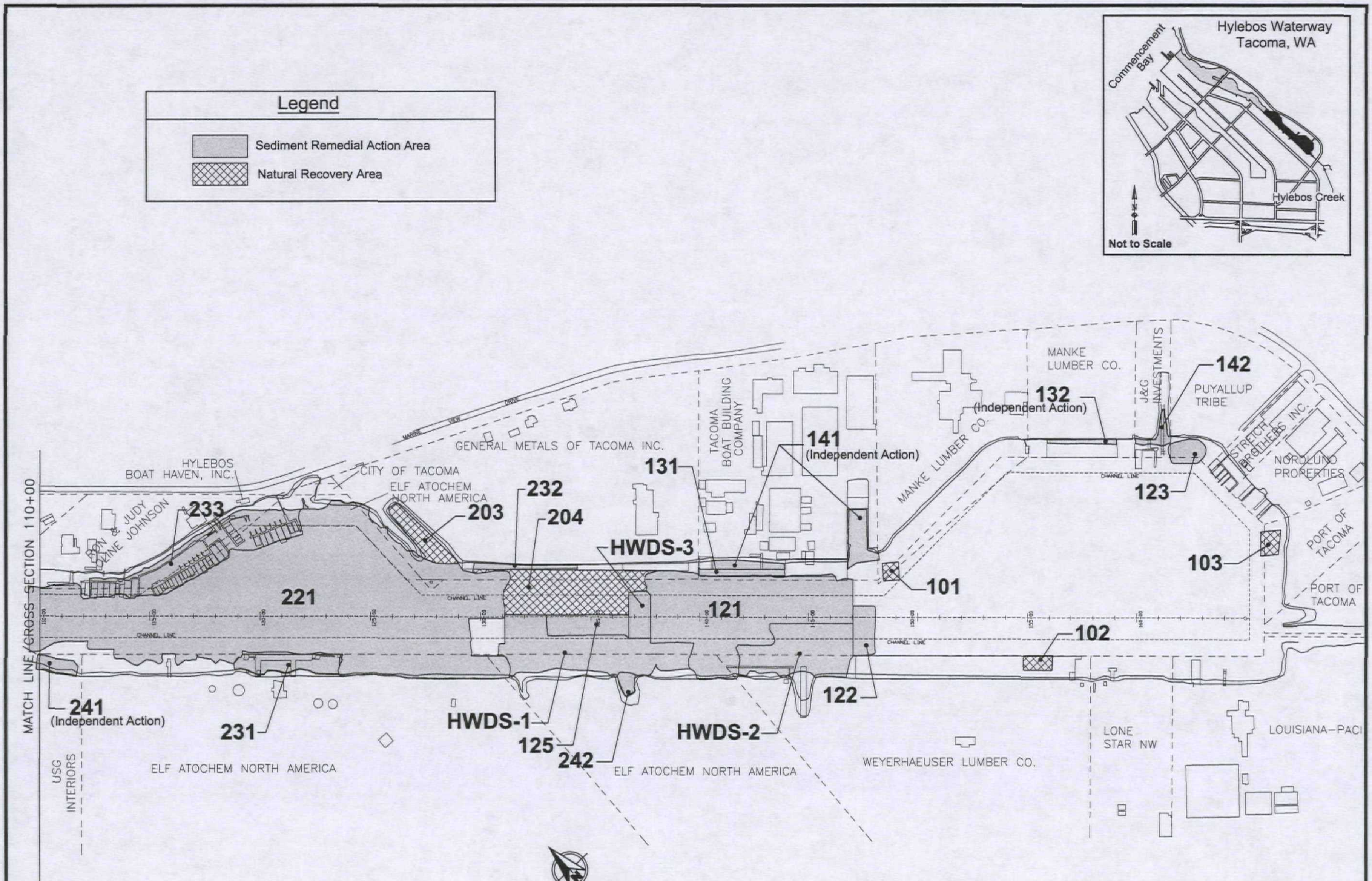
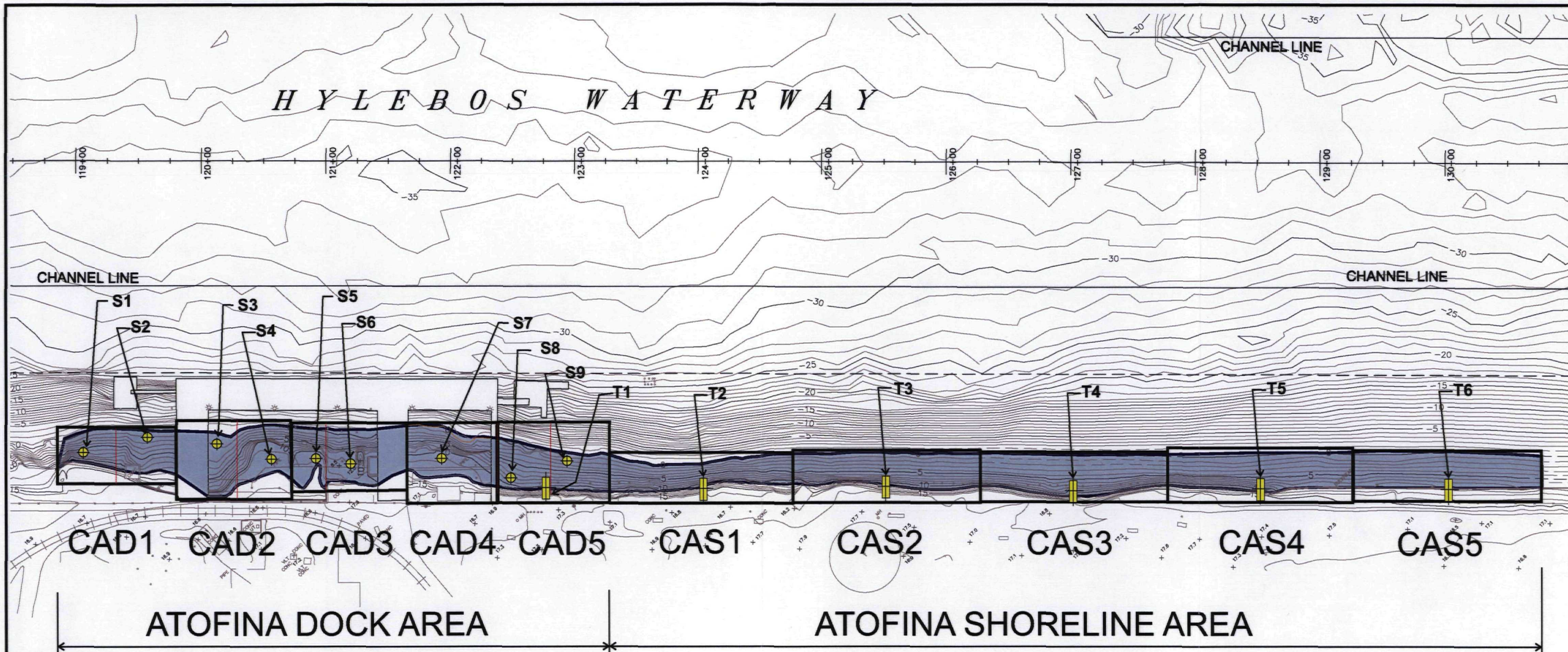
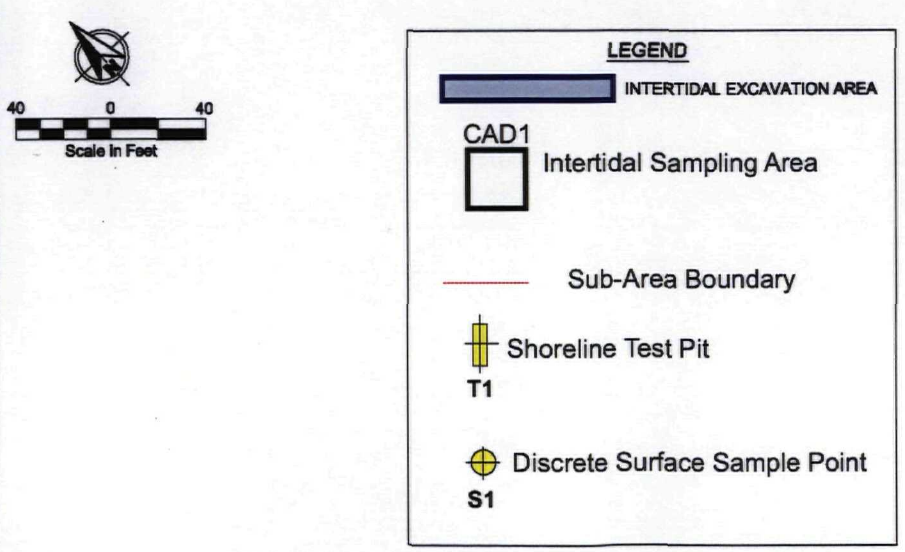


Figure 1-2
EPA Cleanup Areas
Head of Hylebos Waterway
EPA's ESD, August 2000

Dalton, Olmsted & Fuglevand, Inc.	July 2002	Hylebos



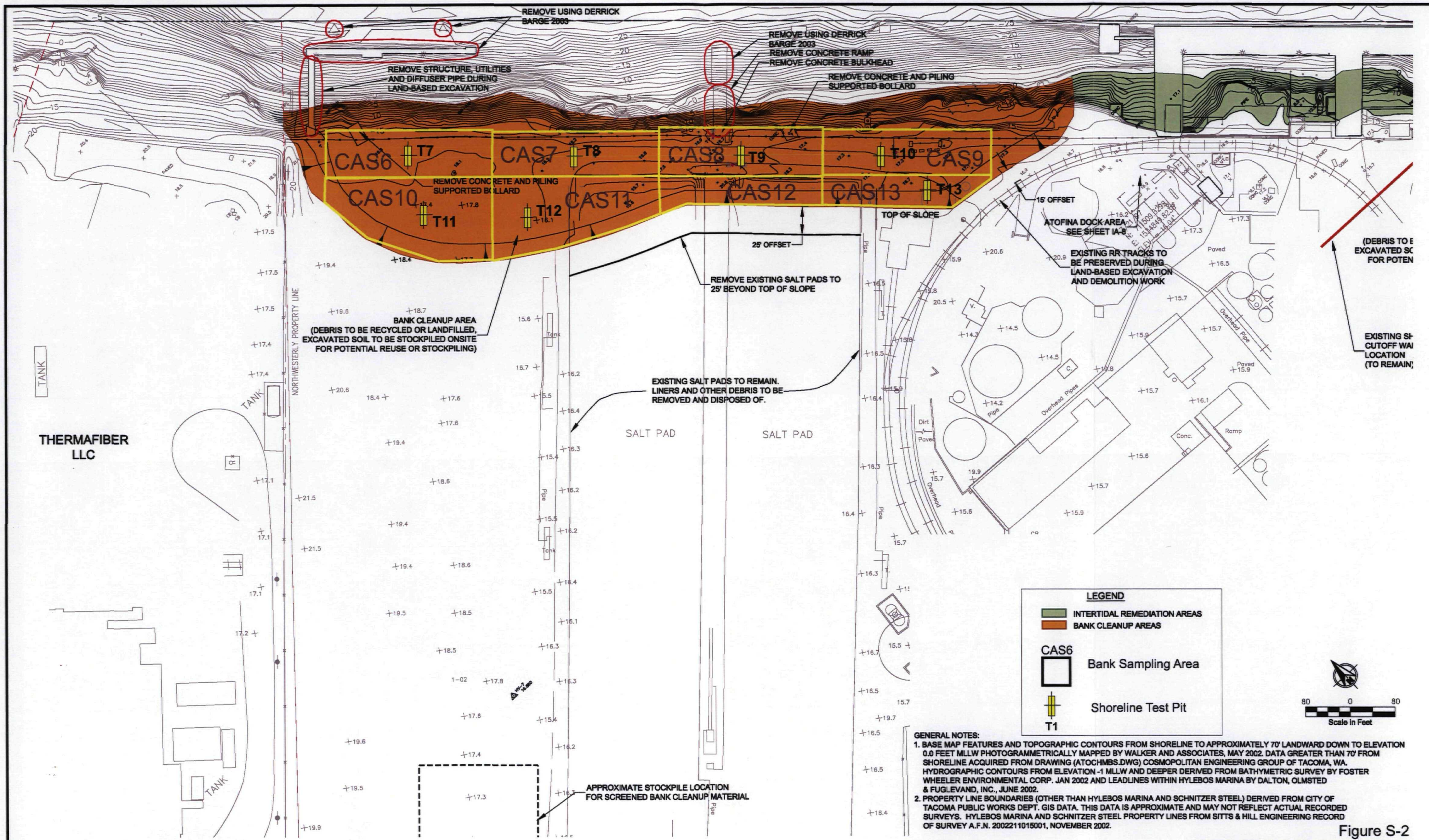


GENERAL NOTES:

1. ALL ELEVATIONS ARE REFERENCED TO N.O.S. MLLW (FEET) VERTICAL DATUM.
2. BASE MAP FEATURES AND CONTOURS (GREATER THAN ELEV. -1 MLLW) PHOTOGRAMMETRICALLY MAPPED BY WALKER AND ASSOCIATES, MAY 2002. BATHYMETRIC CONTOURS (ELEV. -2 AND DEEPER) DERIVED FROM BATHYMETRIC SURVEY BY FOSTER WHEELER ENVIRONMENTAL CORP. JAN 2002 AND LEADLINE SURVEY WITHIN HYLEBOS MARINA BY DALTON, OLMSTED & FUGLEVAND, INC., JUNE 2002.
3. PROPERTY LINE BOUNDARIES (OTHER THAN HYLEBOS MARINA AND SCHNITZER STEEL) DERIVED FROM CITY OF TACOMA PUBLIC WORKS DEPT. GIS DATA. THIS DATA IS APPROXIMATE AND MAY NOT REFLECT ACTUAL RECORDED SURVEYS. PROPERTY LINES FOR HYLEBOS MARINA AND SCHNITZER STEEL (GENERAL METALS) DERIVED FROM RECORD OF SURVEY BY SITTS & HILL ENGINEERING, INC., OCTOBER 2002.

Figure S-1
Intertidal Characterization Samples
ATOFINA
Head of Hylebos Waterway

Dalton, Olmsted & Fuglevand, Inc.	April 2003	Hylebos

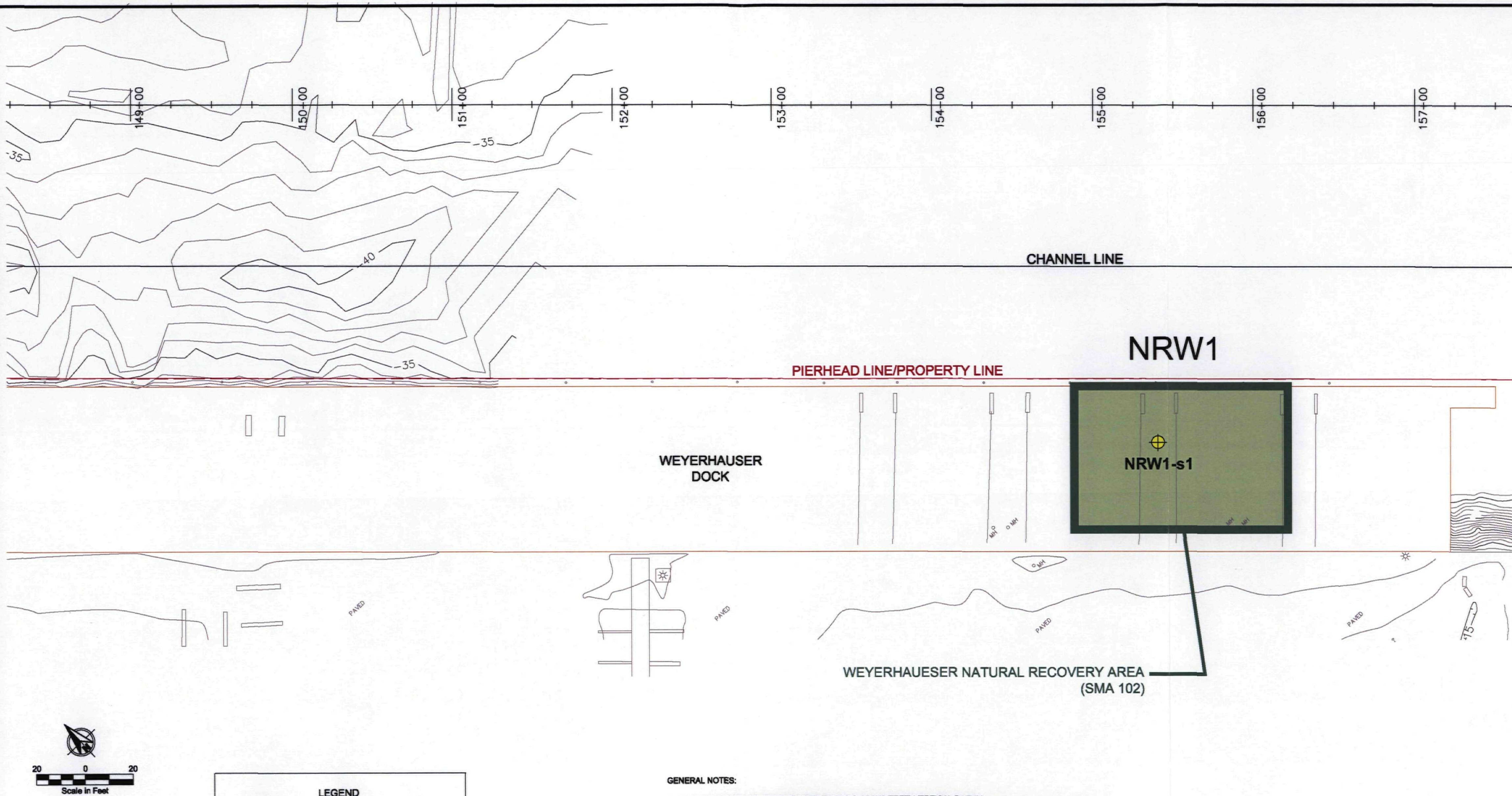


GENERAL NOTES:

1. BASE MAP FEATURES AND TOPOGRAPHIC CONTOURS FROM SHORELINE TO APPROXIMATELY 70' LANDWARD DOWN TO ELEVATION 0.0 FEET MLLW PHOTOGRAMMETRICALLY MAPPED BY WALKER AND ASSOCIATES, MAY 2002. DATA GREATER THAN 70' FROM SHORELINE ACQUIRED FROM DRAWING (ATOCHMBS.DWG) COSMOPOLITAN ENGINEERING GROUP OF TACOMA, WA. HYDROGRAPHIC CONTOURS FROM ELEVATION -1 MLLW AND DEEPER DERIVED FROM BATHYMETRIC SURVEY BY FOSTER WHEELER ENVIRONMENTAL CORP. JAN 2002 AND LEADLINES WITHIN HYLEBOS MARINA BY DALTON, OLMSTED & FUGLEVAND, INC., JUNE 2002.
2. PROPERTY LINE BOUNDARIES (OTHER THAN HYLEBOS MARINA AND SCHNITZER STEEL) DERIVED FROM CITY OF TACOMA PUBLIC WORKS DEPT. GIS DATA. THIS DATA IS APPROXIMATE AND MAY NOT REFLECT ACTUAL RECORDED SURVEYS. HYLEBOS MARINA AND SCHNITZER STEEL PROPERTY LINES FROM SITTS & HILL ENGINEERING RECORD OF SURVEY A.F.N. 2002211015001, NOVEMBER 2002.

Figure S-2
Bank Characterization Samples
ATOFINA
Head of Hylebos Waterway

Dalton, Olmsted & Fuglevand, Inc.	April 2003	Hylebos



LEGEND

NRW1 Natural Recovery Area

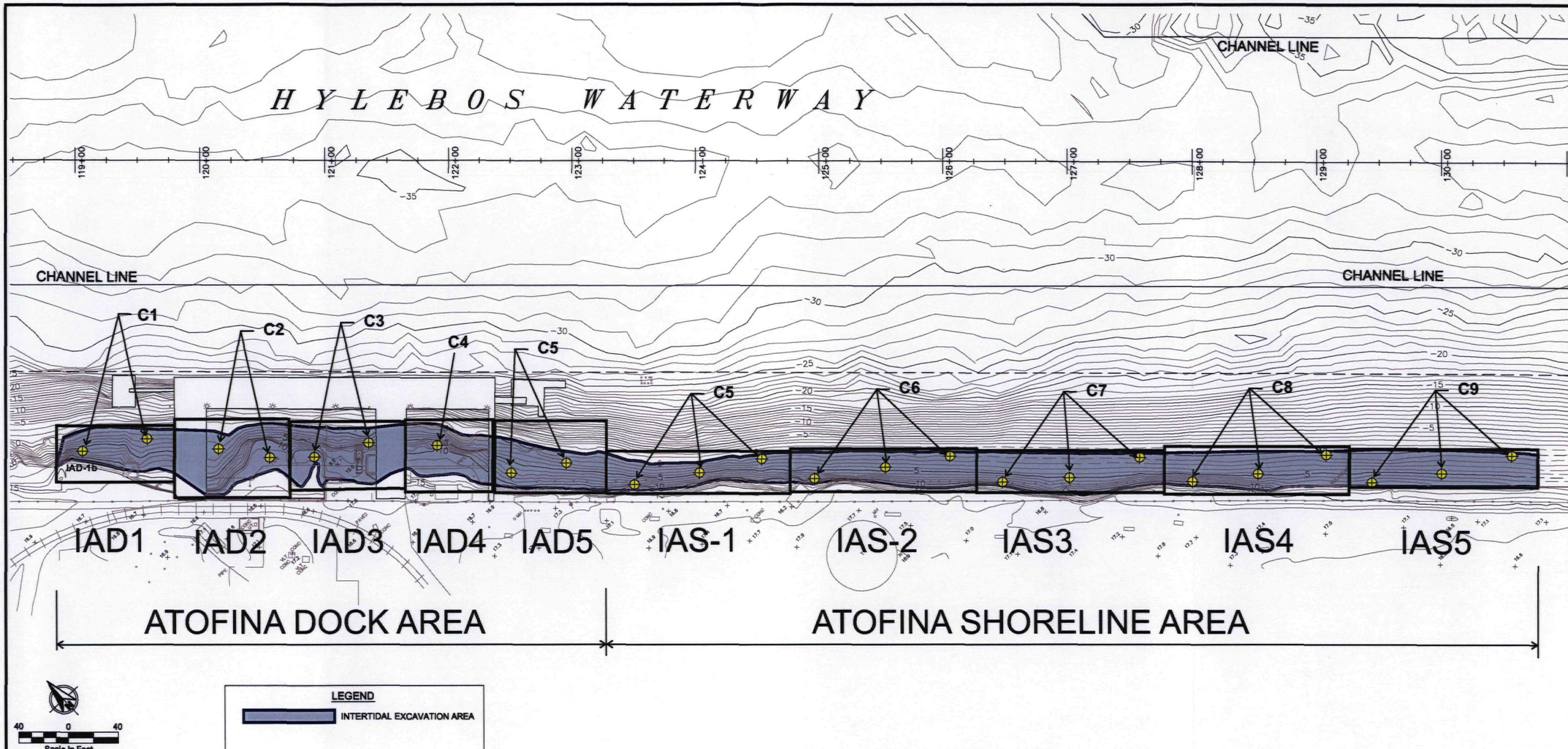
Discrete Surface Sample Point **NRW1-s1**

GENERAL NOTES:

1. ALL ELEVATIONS ARE REFERENCED TO N.O.S. MLLW (FEET) VERTICAL DATUM.
2. BASE MAP FEATURES AND CONTOURS (GREATER THAN ELEV. -1 MLLW) PHOTOGRAMMETRICALLY MAPPED BY WALKER AND ASSOCIATES, MAY 2002. BATHYMETRIC CONTOURS (ELEV. -2 AND DEEPER) DERIVED FROM BATHYMETRIC SURVEY BY FOSTER WHEELER ENVIRONMENTAL CORP. JAN 2002 AND LEADLINE SURVEY WITHIN HYLEBOS MARINA BY DALTON, OLMSTED & FUGLEVAND, INC., JUNE 2002.
3. PROPERTY LINE BOUNDARIES (OTHER THAN HYLEBOS MARINA AND SCHNITZER STEEL) DERIVED FROM CITY OF TACOMA PUBLIC WORKS DEPT. GIS DATA. THIS DATA IS APPROXIMATE AND MAY NOT REFLECT ACTUAL RECORDED SURVEYS.

Figure S-3
Weyerhaeuser Natural Recovery Area Sampling
Head of Hylebos Waterway

Dalton, Olmsted & Fuglevand, Inc.	April 2003	Hylebos



LEGEND

INTERTIDAL EXCAVATION AREA

IAD1 — Intertidal Sampling Area

Discrete Sample Point

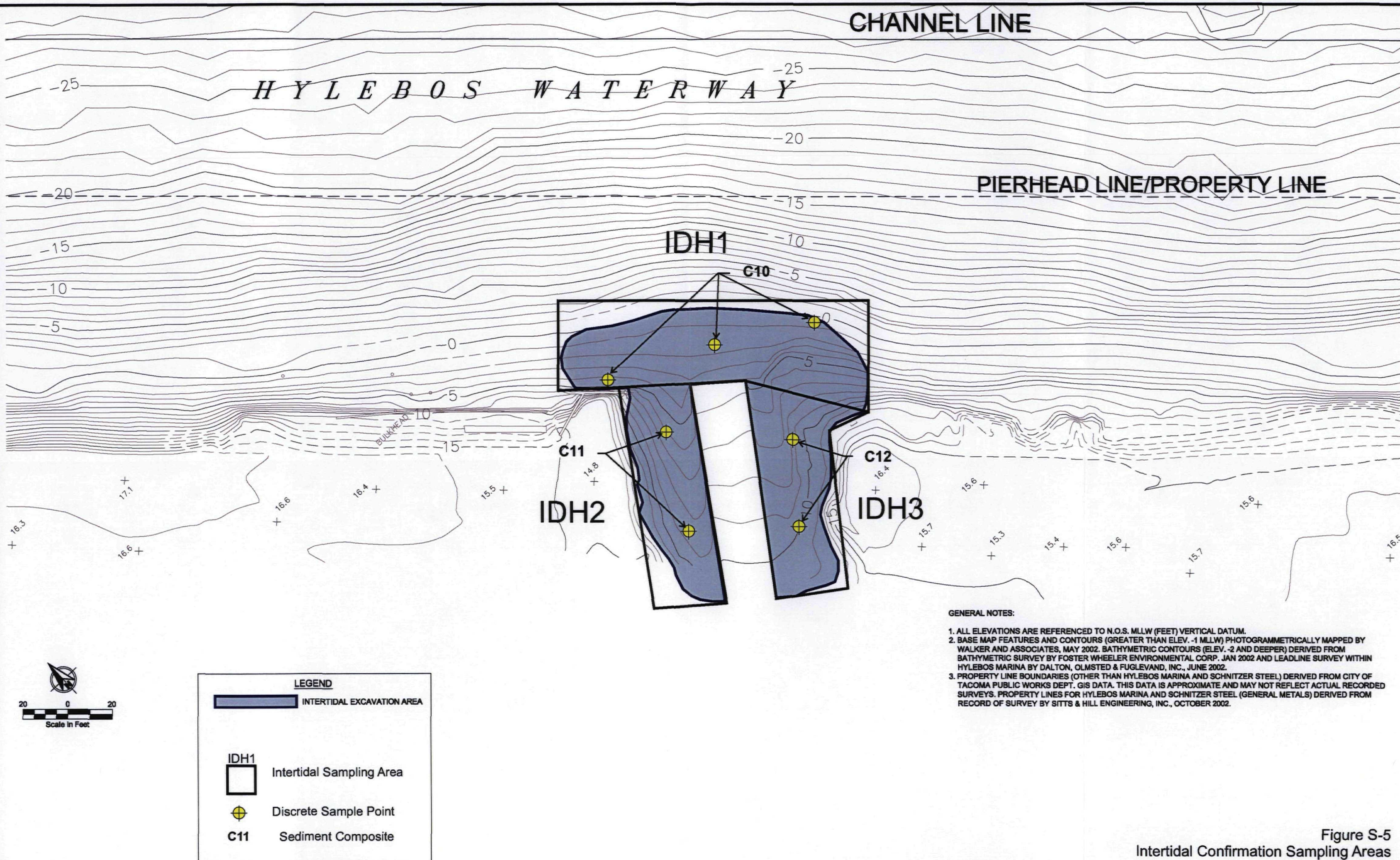
C1 — Sediment Composite

GENERAL NOTES:

1. ALL ELEVATIONS ARE REFERENCED TO N.O.S. MLLW (FEET) VERTICAL DATUM.
2. BASE MAP FEATURES AND CONTOURS (GREATER THAN ELEV. -1 MLLW) PHOTOGRAMMETRICALLY MAPPED BY WALKER AND ASSOCIATES, MAY 2002. BATHYMETRIC CONTOURS (ELEV. -2 AND DEEPER) DERIVED FROM BATHYMETRIC SURVEY BY FOSTER WHEELER ENVIRONMENTAL CORP. JAN 2002 AND LEADLINE SURVEY WITHIN HYLEBOS MARINA BY DALTON, OLMSTED & FUGLEVAND, INC., JUNE 2002.
3. PROPERTY LINE BOUNDARIES (OTHER THAN HYLEBOS MARINA AND SCHNITZER STEEL) DERIVED FROM CITY OF TACOMA PUBLIC WORKS DEPT. GIS DATA. THIS DATA IS APPROXIMATE AND MAY NOT REFLECT ACTUAL RECORDED SURVEYS. PROPERTY LINES FOR HYLEBOS MARINA AND SCHNITZER STEEL (GENERAL METALS) DERIVED FROM RECORD OF SURVEY BY SITTS & HILL ENGINEERING, INC., OCTOBER 2002.

Figure S-4
Intertidal Confirmation Sampling Areas
ATOFINA
Head of Hylebos Waterway

Dalton, Olmsted & Fuglevand, Inc.	April 2003	Hylebos

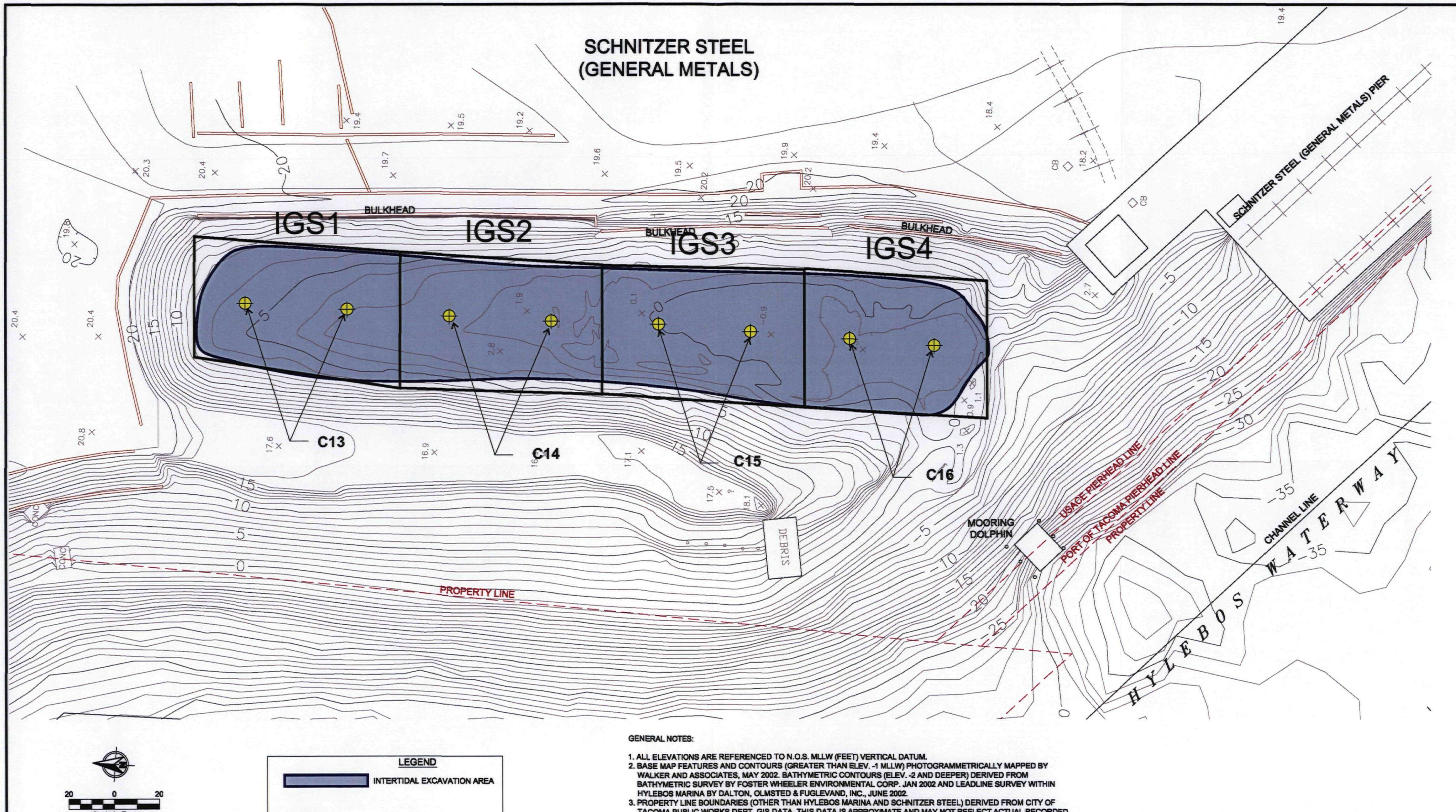


GENERAL NOTES:

1. ALL ELEVATIONS ARE REFERENCED TO N.O.S. MLLW (FEET) VERTICAL DATUM.
2. BASE MAP FEATURES AND CONTOURS (GREATER THAN ELEV. -1 MLLW) PHOTOGRAMMETRICALLY MAPPED BY WALKER AND ASSOCIATES, MAY 2002. BATHYMETRIC CONTOURS (ELEV. -2 AND DEEPER) DERIVED FROM BATHYMETRIC SURVEY BY FOSTER WHEELER ENVIRONMENTAL CORP. JAN 2002 AND LEADLINE SURVEY WITHIN HYLEBOS MARINA BY DALTON, OLMSTED & FUGLEVAND, INC., JUNE 2002.
3. PROPERTY LINE BOUNDARIES (OTHER THAN HYLEBOS MARINA AND SCHNITZER STEEL) DERIVED FROM CITY OF TACOMA PUBLIC WORKS DEPT. GIS DATA. THIS DATA IS APPROXIMATE AND MAY NOT REFLECT ACTUAL RECORDED SURVEYS. PROPERTY LINES FOR HYLEBOS MARINA AND SCHNITZER STEEL (GENERAL METALS) DERIVED FROM RECORD OF SURVEY BY SITTS & HILL ENGINEERING, INC., OCTOBER 2002.

Figure S-5
Intertidal Confirmation Sampling Areas
Dunlap Log Haulout
Head of Hylebos Waterway

Dalton, Olmsted & Fuglevand, Inc.	April 2003	Hylebos



LEGEND

INTERTIDAL EXCAVATION AREA

IGS-1 Intertidal Sampling Area

Discrete Sample Point

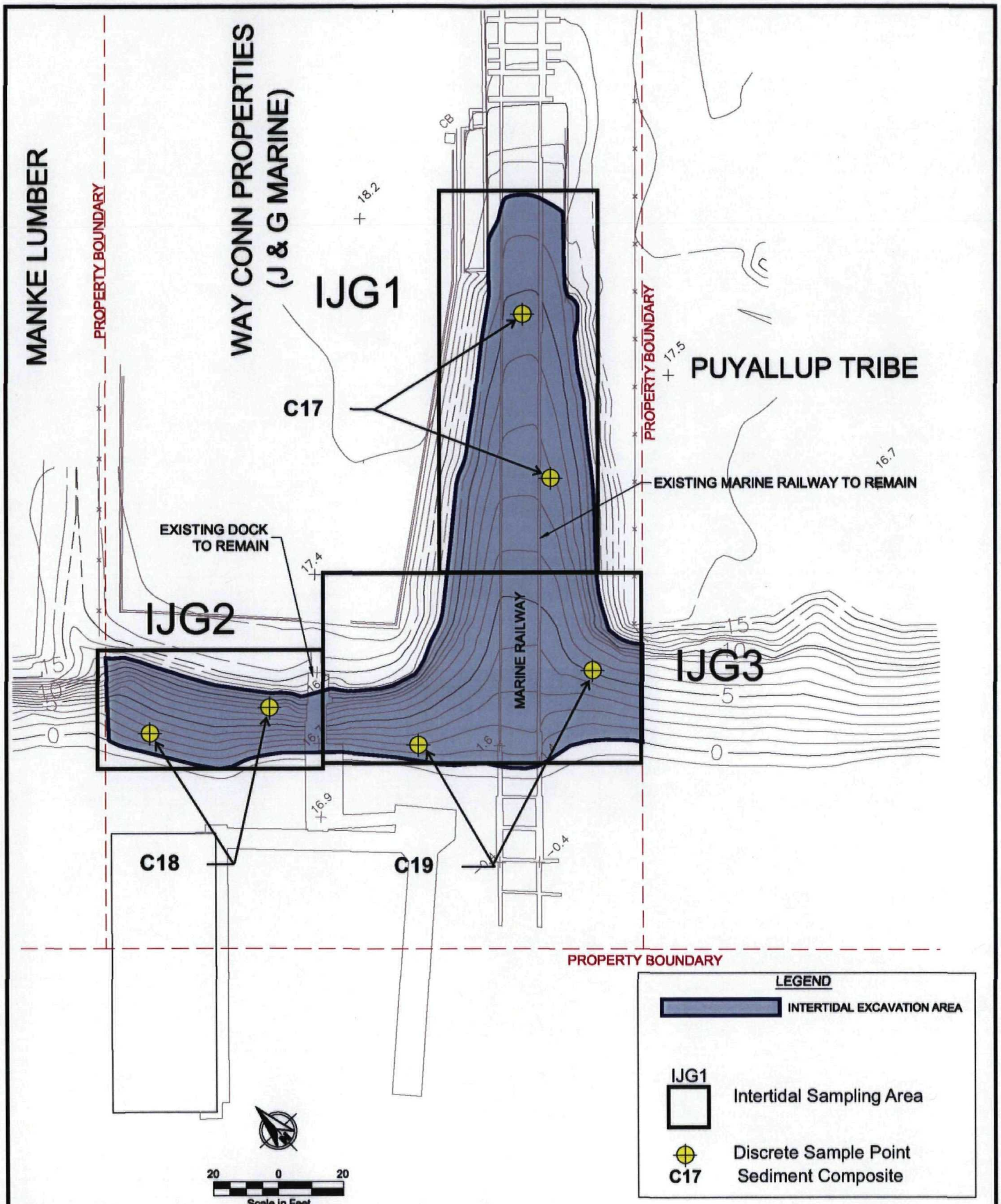
C13 Sediment Composite

GENERAL NOTES:

1. ALL ELEVATIONS ARE REFERENCED TO N.O.S. MLLW (FEET) VERTICAL DATUM.
2. BASE MAP FEATURES AND CONTOURS (GREATER THAN ELEV. -1 MLLW) PHOTOGRAMMETRICALLY MAPPED BY WALKER AND ASSOCIATES, MAY 2002. BATHYMETRIC CONTOURS (ELEV. -2 AND DEEPER) DERIVED FROM BATHYMETRIC SURVEY BY FOSTER WHEELER ENVIRONMENTAL CORP. JAN 2002 AND LEADLINE SURVEY WITHIN HYLEBOS MARINA BY DALTON, OLMSTED & FUGLEVAND, INC., JUNE 2002.
3. PROPERTY LINE BOUNDARIES (OTHER THAN HYLEBOS MARINA AND SCHNITZER STEEL) DERIVED FROM CITY OF TACOMA PUBLIC WORKS DEPT. GIS DATA. THIS DATA IS APPROXIMATE AND MAY NOT REFLECT ACTUAL RECORDED SURVEYS. PROPERTY LINES FOR HYLEBOS MARINA AND SCHNITZER STEEL (GENERAL METALS) DERIVED FROM RECORD OF SURVEY BY SITTS & HILL ENGINEERING, INC., OCTOBER 2002.

Figure S-6
Intertidal Confirmation Sampling Areas
General Metals Graving Slip
Head of Hylebos Waterway

Dalton, Olmsted & Fuglevand, Inc.	April 2003	Hylebos



GENERAL NOTES:
1. ALL ELEVATIONS ARE REFERENCED TO N.O.S. MLLW (FEET) VERTICAL DATUM
2. CONTOURS PHOTOGRAMMETRICALLY MAPPED BY WALKER AND ASSOCIATES MAY 2002.
3. STRUCTURES DERIVED FROM PHOTOGRAMMETRICALLY MAPPED DATA.
4. PROPERTY LINE BOUNDARIES DERIVED FROM CITY OF TACOMA PUBLIC WORKS DEPT. GIS DATA. THIS DATA IS APPROXIMATE AND MAY NOT REFLECT ACTUAL RECORDED SURVEYS.

Figure S-7
Intertidal Confirmation Sampling Areas
J&G Marine (Way Conn Prop.)
Head of Hylebos Waterway

Dalton, Olmsted & Fuglevand, Inc.	April 2003	Hylebos

Attachment A

Review of

Combined SAP/QAPP
for the Commencement Bay / Nearshore Tideflats Superfund Site
Hylebos Waterway Problem Area
Striplin Environmental Associates, Inc.
Science Applications International Corporation
D.M.D., Inc.
Dalton, Olmsted & Fuglevand, Inc.
Converse Consultants NW, Inc.
June 17, 1994

D.M.D., Inc.
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MEMORANDUM

TO: Paul Fuglevand (DOF)

FROM: Raleigh Farlow

DATE: March 17, 2003

SUBJECT: Applicability and Use of the "Combined SAP/QAPP for the Commencement Bay Nearshore/Tideflats Superfund Site - Hylebos Waterway Problem Areas", June 17, 1994 for the **Head of Hylebos Waterway Construction Design**

The proposed Sediment Sampling Operations Manual (SSOM) for performance of sediment sampling and compliance monitoring during dredging at the head of the Hylebos Waterway problem areas references the "Combined SAP/QAPP for the Commencement Bay Nearshore/Tideflats Superfund Site - Hylebos Waterway Problem Areas", June 17, 1994, (HCC-QAPP) and pertinent sections for management of project quality assurance.

The Project and QA Management team for the proposed head of Hylebos construction is essentially the same employed for the Hylebos Waterway predesign program, which developed and followed the HCC-QAPP. The proposed project laboratory(ies) is(are) also the same as used during the predesign. The project monitoring performance goals identified in the SSOM are the same as for the predesign program. As much as possible, where appropriate, the SSOM attempts to apply the monitoring requirements and management philosophy and protocols of the predesign program to the construction phase of the project.

The SSOM presents QA requirements for the proposed work and calls out specific sections of the HCC-QAPP, where appropriate. These sections are the following:

HCC-QAPP Section	Description
4.1	Monitoring Program Objectives
3	Monitoring Team Organization
7	Analytical Methods
5	Laboratory QA/QC
6.3.2	Field Personnel Responsibilities
6.4.2	Equipment Decontamination
6.4.3.4	Diver Sampling Procedures
6.4.3.1 & 6.4.3.3	Open-Water Sampling Procedures
6.4.3, 6.6 & Table 9	Sample Processing & Handling
6.5	C-O-C Procedures
7.1.2 & Table 6	Analytical Procedures & Reporting Limits
7.1.2	Laboratory QC Requirements
Table 15	Analytical Performance Goals & Criteria

The SSOM and the referenced sections from the HCC-QAPP were reviewed for applicability to the proposed monitoring. The following are changes to the HCC-QAPP, which are also identified in the SSOM.

Section 3 of the HCC-QAPP describes project organization. Field staff, management and coordination for the proposed effort will be provided by Dalton, Olmsted & Fuglevand, Inc. (DOF). Either ARI of Tukwila or CAS of Kelso or both will provide laboratory services. No contaminant mobility tests, sediment bioassays or benthic infauna classifications are required. Project data management will be shared between DOF and D.M.D., Inc.

Analytical methods and approach are presented in Section 7 of the HCC-QAPP, as indicated in the SSOM. Methods identified in the HCC-QAPP for sediment analyses are appropriate for meeting the needs of the proposed effort. The use of the same methods (preremedial design *vs.* construction phase) reduces the number of factors that could affect variability in the project database. The proposed methods have been demonstrated (during the preremedial design) in the hands of the proposed laboratories to be sufficiently robust to achieve project analytical objectives.

Section 5 of the HCC-QAPP describes the overall program DQOs with reference to specific laboratory QA/QC requirements in HCC-QAPP Tables 6, 9, 14 and 15. Table 14 identifies the number of project field and associated QC samples planned during the HCC preremedial design characterization. These numbers will change, of course, for the [new] proposed effort, however the types and frequencies of QC samples should remain the same. Externally introduced PEs or blind SRMs are not planned for this effort.

Equipment decontamination for the proposed effort will be similar to what was used during the preremedial design, with the exception of the deletion of a 0.1 N nitric acid rinse. Methanol (plus "elbow grease") is recommended when high levels of organic contamination are apparent (visually and/or olfactory obvious).

Sample processing and handling is appropriate as described in the HCC-QAPP, which is consistent with current guidance and regulations. C-O-C procedures, as described in the HCC-QAPP, are appropriate for the proposed effort.

Laboratory analytical procedures, methods, reporting limits and QC requirements, as described in the HCC-QAPP, are sufficient to meet the objectives of the construction phase of this project. Sediments only are proposed for analyses using the methodologies identified in Section 7.1.2 of the HCC-QAPP. Metals analyses will be performed utilizing the QC requirements and methodologies described in the CLP IFB/SOW ILM04.0. SVOCs (ABNs) will be analyzed following the requirements and methodology described in the CLP IFB/SOW ILM4.0 using the normal list of surrogate and MS/MSD compounds. Florisil chromatography, and in some cases silica gel chromatography for especially problematic extracts, will be used for chlorinated pesticide and PCBs cleanup prior to instrumental analysis. The use of concentrated sulfuric acid for cleanup of PCB extracts will be used at the discretion of the analyst, when required. Table 6 in the HCC-QAPP presents the analytical detection limit goals (expressed as PRQLs) intended for use in the proposed effort.

In summary, the use of HCC-QAPP requirements for the monitoring of sediments during the construction phase of this project, as proposed in the SSOM, is appropriate for meeting the needs of the proposed work. Attached are the pertinent sections and tables from the HCC-QAPP (6/17/94 - final version).

Combined Sampling and Analysis Plan and Quality Assurance Project Plan for the Commencement Bay Nearshore/Tideflats Superfund Site - Hylebos Waterway Problem Areas

Final Report

June 17, 1994

Prepared For the Hylebos Cleanup Committee Which Currently Consists of:

ASARCO, Inc.
Elf Atochem North America, Inc.
General Metals of Tacoma, Inc.
Kaiser Aluminum & Chemical Corporation
Occidental Chemical Corporation
Port of Tacoma

Prepared By:

Striplin Environmental Associates, Inc.
Science Applications International Corporation
D.M.D., Inc.
Dalton, Olmsted & Fuglevand, Inc.
Converse Consultants NW, Inc.

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LIST OF ACRONYMS

AET	Apparent effects threshold
2LAET	Second lowest apparent effects threshold
ACOE	U.S. Army Corps of Engineers (see also USACOE, COE)
AOC	Administrative Order on Consent
ARAR	Applicable or relevant and appropriate requirements
ASTM	American Society of Testing and Materials
CB/NT	Commencement Bay Nearshore/Tideflats
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CLP	Contract Laboratory Program (EPA)
CLT	Column leach test
cm	centimeter
COE	U.S. Army Corps of Engineers
CRQL	Contract required quantitation limit
CVAA	Cold vapor atomic absorption
DGPS	Differential global positioning system
DMMO	Dredged Material Management Office (Seattle District, Corps of Engineers)
DMMU	Dredged material management unit
DQO	Data quality objective
EDM	Electronic distance measurement
EPA	U.S. Environmental Protection Agency
FS	Feasibility Study
g	gravimetric constant
GC/ECD	Gas chromatography/electron capture detection
GC/MS	Gas chromatography/mass spectrometry
GPS	Global positioning system
HCBD	Hexachlorobutadiene
HCC	Hylebos Cleanup Committee
HPAH	High molecular weight polycyclic aromatic hydrocarbons
HSP	Health and safety plan
ICP	Inductively coupled plasma
ID	Identification or identification number
IFB	Invitation to bid
LPAH	Low molecular weight polycyclic aromatic hydrocarbons
m	meter
ml	milliliter
MLLW	Mean lower low water
mm	millimeter

MSDS	Material safety data sheet
MSMT	Marine sediment monitoring task (of the Puget Sound Ambient Monitoring Program)
NCD	Nearshore confined disposal
ng	nanogram
NPDES	National Pollutant Discharge Elimination System
PAH	Polycyclic aromatic hydrocarbons
PARCC	Precision, accuracy, representativeness, comparability, and completeness
PCBs	Polychlorinated biphenyls
PRQL	Project required quantitation limit
PSAMP	Puget Sound Ambient Monitoring Program
PSDDA	Puget Sound Dredged Disposal Analysis
PSEP	Puget Sound Estuary Program (of U.S. EPA Region X)
PWE	Porewater extraction tests
QA	Quality assurance
QAPP	Quality assurance project plan
QC	Quality control
R/V	Research vessel
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
ROD	Record of Decision
RPD	Relative percent difference
RPM	Remedial Project Manager (U.S. EPA)
SAP	Sampling and analysis plan
SBLT	Sequential batch leach test
SEA	Striplin Environmental Associates
SIM	Selective ion monitoring
SMS	Sediment Management Standards (of the State of Washington, WAC 173-204)
SOP	Standard operating procedures
SOW	Statement of work
SQO	Sediment quality objective
TPCHD	Tacoma-Pierce County Health Department
UCL	Upper control limit
USACOE	U.S. Army Corps of Engineers
USC	Unified soil classification
UWL	Upper warning limit
VOA	Volatile organic analysis
WAC	Washington Administrative Code
WES	Waterways Experiment Station (of the U.S. Army Corps of Engineers)

4.0 PROJECT DESCRIPTION

This section provides an overview of the sampling and analysis portions of the Hylebos Waterway Pre-Remedial Design project. It contains study objectives, a description of the study area, an evaluation of chemical sources to the waterway, the project design, and the project schedule per the AOC/SOW.

4.1 OBJECTIVES OF THE PRE-REMEDIAL DESIGN SAMPLING PROGRAMS

4.1.1 Program Objectives

The purpose of pre-remedial design activities is to provide sufficient data, analysis, and engineering evaluations to support EPA's selection of a final remediation plan. Sampling and analysis activities covered by this combined SAP/QAPP will be aimed toward defining the spatial resolution of chemical concentrations, characterizing physical attributes of the waterway sediments, assessing sediment toxicity, assessing contaminant mobility, and evaluating the potential for sediment recontamination once the remedy is implemented.

4.1.2 Quality Assurance Objectives

The quality assurance objectives of this program are to develop and implement procedures to provide data of known quality. General data quality objectives are to provide physical, chemical, and biological data that are of sufficient accuracy to determine the areas and sediment volumes requiring remediation and to assess the effectiveness of remedial action alternatives. Data quality objectives are qualitatively defined in Section 5.0, and quantitative quality assurance goals are provided in Section 7.0.

4.2 HYLEBOS WATERWAY STUDY AREA

4.2.1 Physical Characteristics

Hylebos Waterway is a manmade waterway that is approximately three miles long. Hylebos Creek, which flows into the head of the waterway, is the only major source of fresh water to the waterway. The mouth of Hylebos Waterway joins Commencement Bay at the northeastern side of the bay.

The Hylebos Waterway is an authorized federal navigation project the first phase of which was constructed in 1931. Starting at the pierhead line in Commencement Bay, a 200-foot wide by 30-foot deep (MLLW) channel was dredged about 2.80 miles up to the present Elf Atochem plant site. In 1938, a 510-foot wide x 1,400-foot long turning basin was added at the upper end of the existing navigation improvements. Finally, in 1965-67, under a project sponsored by the Port of Tacoma, the 200-ft x 30-ft channel was extended approximately 0.4 mi. upstream and a new, upper turning basin was constructed. Dimensions of the upper turning basin are: length 1,807 feet, width 770 feet and depth 30 feet. Total length of the navigation channel including turning basins is 3.14 miles. The channel has been dredged and periodically maintained by the Corps of Engineers as reflected in Table 2. Dredging occurred to depths of approximately 32 to 36 feet below mean lower low water (-32 to -36 ft MLLW). The Port of Tacoma and numerous owners of private property along the waterway have also dredged for berthing and docking of vessels at their facilities. A chronology of this dredging from 1969 (the earliest date that Corps' dredging permit records which are readily accessible) is shown on Table 3. Estimated dredged material quantities authorized by the permits were not included in the Corps' dredging permit records.

The majority of the navigation channel in Hylebos Waterway is currently (i.e., spring 1993) at a depth of -30 to -32 ft MLLW (Figures 4a - c). Areas of significant accumulations of sediment include some locations at the toe of slopes (outside of the navigation channel) and near the mouth of Hylebos Creek, at the head of the waterway. Isopach maps of the waterway are shown in Figures 5a - c. They were prepared by contouring the difference between the deepest dredging depth, based on historical bathymetric survey data, and the 1993 bathymetric data. The isopach maps reveal little sediment accumulation in the navigation channel. Accumulation in the nearshore areas is a combined result of bank sloughing and sediment resuspension and deposition outside of the areas affected by ship traffic.

4.2.2 Uses of the Waterway

Development in Hylebos Waterway began near the mouth, and moved progressively toward the head following its creation by the U.S. Army Corps of Engineers. Since it was first dredged, Hylebos Waterway has been the site of a large number of industrial facilities. Categories of industries that have operated or currently operate on the waterway include chemical producers, shipyards, pulp mills, petroleum refining and storage facilities, marinas, wood product manufacturers, log sort yards, and metal recyclers. Nearly all former and current industries located along the waterway have discharged to the waterway, including discharges from storm drains and surface runoff.

4.2.3 Distributions of Chemicals in Sediment

The CB/NT RI and FS (Tetra Tech 1985, 1988) are the major sources of environmental information on the waterway. Other studies, funded by the Port of Tacoma, industries currently situated on the waterway, and federal and state agencies, also provide chemical and occasional biological data. These studies show chemicals distributed in sediment in various parts of the waterway. The RI states that biological effects are associated with some of the impacted sediments.

4.3 SUMMARY OF AVAILABLE INFORMATION

This section contains a concise summary of the known existing and available information on potential sources to Hylebos Waterway and the distributions of sediment-borne chemicals in the waterway. The following information is provided to assist in the selection of sampling locations. A more thorough summary of existing information will be provided to EPA in the Summary of Existing Information report. This report will be submitted in accordance with Section II.B.2.a of the SOW (EPA 1993). Information was obtained from the RI/FS, Port of Tacoma, Tacoma-Pierce County Health Department, and Ecology.

4.3.1 Identification of Potential Sources to Hylebos Waterway

Chemicals may enter Hylebos Waterway through outfalls, surface runoff, ditches, storm drains, groundwater seeps, and on-water spills, as well as via Hylebos Creek. The most up-to-date summary of the locations of known conduits to the waterway was provided by the Tacoma-Pierce County Health Department (TPCHD) in the form of a 1988 map of drainage patterns throughout Commencement Bay. Drainage information as of 1988 is presented in Figures 6a - c and a key to the outfall numbers is provided as Table 4. Since publication of the map, several industries have closed off drains or outfalls, but a comprehensive revision of the TPCHD map has not been produced.

Also shown on Figures 6a - c are the boundaries of properties located in the vicinity of Hylebos Waterway. Property boundaries were obtained in digital format from the City of Tacoma's Office of Planning and Development Services. In many instances, current property owners are identified. Knowledge of current property owners and property locations is useful for deriving information on recent potential sources of chemicals to the waterway. However, previous occupants of these properties may have released chemicals of unknown composition and concentration to the waterway. A more detailed evaluation of sources will be provided in the Summary of Existing Information report.

4.3.2 Trends in Chemical Distributions

The following discussion of trends in the distributions of chemicals in Hylebos Waterway was derived primarily from the RI and FS (Tetra Tech 1985, 1988). Older data were not evaluated because the RI sampling grid covered the entire waterway. More recent data, including the Department of Ecology's sediment trap study (Norton and Barnard 1992) and a compilation of source information by the Port of Tacoma (Coffey 1992), are also discussed.

In the RI/FS and ROD, parts of the head and the mouth of the Hylebos Waterway were identified as potential areas for remedial action. These two areas of the waterway were designated as part of Operable Unit 1 of the CB/NT site. Hylebos Waterway was divided into five segments (HYS1–HYS5 in the RI; 1-5 in this document) based on apparent trends in chemical distributions (Figure 7).

In the RI, numerous organic and inorganic compounds were found to occur at concentrations that exceeded those in reference sediments. Compounds whose concentrations exceeded all Puget Sound reference conditions were called chemicals of concern. Chemicals detected at concentrations that exceeded the 80th percentile of the values for all of Commencement Bay were determined to be priority chemicals of concern. They were assigned a priority based on their apparent correlation with biological effects and the number of stations where concentrations exceeded an Apparent Effects Threshold (AET). As stated in the RI:

> Priority 1 chemicals were present above an AET and their distributions corresponded with gradients of observed toxicity or benthic effects. Priority 2 chemicals were also above an AET in the problem area, but these chemicals either showed no particular relationship with gradients of observed toxicity or benthic effects, or insufficient data were available to evaluate their correspondence with gradients. Chemicals with concentrations that were predicted to be above the apparent effects thresholds at non-biological stations were placed no higher than priority 2 because of the lack of biological data. Finally, chemicals with concentrations above an apparent effects threshold at only one station within the problem area are Priority 3.

The priority chemicals found in Hylebos Waterway during the RI are shown in Table 5. In the RI, the segments were ranked based on the priority chemicals and a toxicity factor. The ranking exercise indicated (in decreasing order of severity) that Segments 2, 1, and 5, were of primary concern, while Segments 4 and 3 were of less concern (Figure 7). The final ranking of problem areas provided in the FS reflected three additional criteria:

- Environmental significance

- Spatial extent of contamination

- Confidence in source identification

Each problem area received a score from 1 to 4 for each criterion. The areas with the highest score were evaluated for remedial action. The FS ranked the segments in the following order of decreasing concern: 5, 1, 2, 4, and 3.

The FS concluded that Segment 5 and a hot spot within Segment 4 contained high enough concentrations of chemicals in the sediments that natural recovery would not occur and that remedial action would be necessary. Segment 5 was therefore combined with the hot spot of Segment 4 into one large segment called the mouth of the Hylebos Waterway.

The presence of high molecular weight polycyclic aromatic hydrocarbons (HPAH) and some metals in sediments in Segments 1 and 2 were also believed to preclude timely natural recovery. Because the distributions of these chemicals spanned the two segments without any apparent pattern, the segments were combined into one large segment called the head of the Hylebos Waterway.

Segment 3 was deemed to contain potential problem sediments, but no confirming biological data were available to confirm it as a problem area. It was not evaluated further in the FS.

More detail about the types, distribution, and possible sources of priority chemicals is provided below for each segment, arranged from mouth to head. This information was extracted from the RI/FS and primarily concerns companies located along the waterway. Other industries which were or were not located on the waterway have also discharged to the waterway via drains and ditches.

<u>4.3.2.1 Segment 5</u>

PCBs were the only priority 1 chemical group identified in Segment 5. Hexachlorobutadiene (HCBD), chlorinated benzenes, chlorinated ethenes, a pentachlorocyclopentane isomer and lead were priority 2 chemicals found in the segment. Mercury, HPAH, copper, zinc, low molecular weight PAH (LPAH), phenol, benzyl alcohol, and biphenyl were the priority 3 chemicals; except for mercury, the chemicals were rated priority 3 on the basis of historical data only.

PCBs and hexachlorobenzene were selected as the indicator chemicals for the entire mouth of the waterway for the RI. These chemicals were selected because their ratio of observed concentration to the long-term cleanup goal was higher over a greater area than for other chemicals. The concentration and distribution of indicator chemicals are extensively discussed in the FS.

The highest concentration of PCBs in the segment occurred along the southeast shoreline adjacent to the 11th Street bridge; concentrations decreased with distance from that shoreline. The depth distribution in the sediments showed a maximum at about 1.4 meters, based on one core taken during the FS.

Concentrations of the chlorinated benzenes were highest approximately 0.75 miles from the mouth of the waterway and decreased with distance from this area. Sediment concentrations of hexachlorobenzene exceeded the cleanup goal over most of the segment. The subsurface maximum, based on one core, occurred at a depth of about 18 inches. The concentration of the maximum was close to that seen in the surface sediment.

Subsequent to the RI, Ecology installed sediment traps in several of the Commencement Bay waterways. Traps were placed in Hylebos Waterway for 1.5 years beginning in 1990 (Norton and Barnard 1992). Two traps were located in Segment 5. Although concentrations of most problem chemicals appeared to have changed only slightly, a few were higher in the trap sediment than in sediment collected during the RI. These compounds included lead, tetrachloroethane, LPAH, hexachlorobutadiene, and HPAH. Concentrations of hexachlorobutadiene, hexachlorobenzene, and total PCBs also exceeded the sediment quality objectives (SQO) developed in the RI/FS in both bottom and trap sediment. Norton and Barnard (1992) concluded that, except for PCBs, there may be ongoing sources of several problem chemicals.

Of the 21 discharge pipes in this segment (TPCHD 1988), one is permitted under the National Pollutant Discharge Elimination System (NPDES)—an industrial discharge from the Occidental Chemical Corporation. Industrial facilities that may be sources of chemicals to this segment include Occidental Chemical Corporation, the Tacoma Boatbuilding Company, PRI Northwest, Inc., and the Port of Tacoma Industrial Yard.

4.3.2.2 Segment 4

No Priority 1 or Priority 2 chemicals were identified for Segment 4 in the RI (Tetra Tech 1985). HPAH, PCBs, HCBD, LPAH, N-nitrosodiphenylamine, benzyl alcohol, dibenzofuran, a pentachlorocyclopentane isomer, and methylpyrenes were identified as Priority 3 chemicals. Of these, HPAH, PCBs, LPAH, and dibenzofuran were included on the basis of historical data only.

One hot spot was found in this segment where benzo(a)pyrene and methylphenol concentrations were particularly high with respect to reference conditions. Concentrations decreased with distance from the hot spot, indicating a nearby source. The hot spot was located in mid-channel off the Taylor Way Property, near RI Station HY-33.

Concentrations of metals and other chlorinated compounds increased with proximity to the adjacent Segment 5, suggesting that the source of these chemicals was in Segment 5. This led to the combining of Segment 5 and part of Segment 4 for evaluation of remedial action.

PCBs were undetected at the station adjacent to Segment 5, however hexachlorobenzene and HPAH were found in the sediment at concentrations exceeding the long-term cleanup goals.

One sediment trap was placed in segment 4 east of the 11th Street bridge by Norton and Barnard (1992). Concentrations of tetrachloroethane and bis(2-ethylhexyl)phthalate were higher in the trap sediment than reported in the RI for an adjacent station. For metals, no differences were observed. One priority chemical (total PCBs) exceeded SQOs in both bottom and trap sediment, and one non-priority chemical (benzoic acid) exceeded SQOs in trap sediment.

Of the 16 pipes that discharge into segment 4 (TPCHD 1988), one is the Sound Refining Company NPDES outfall. Also, two seeps discharge to the waterway. Potential sources of chemicals to the waterway include Occidental Chemical Corporation, the Rail Steel Locomotive yards, Cenex Feed Plant, Nordland Boat Co. Inc., Brazier Lumber Co., an old pulp mill, and the City of Tacoma's Public Utilities facility.

4.3.2.3 Segment 3

Segment 3 of the Waterway was identified as a non-problem area in the RI and was only peripherally discussed in the FS. There were no priority 1 chemicals identified in the segment. Priority 2 chemicals were PCBs, arsenic, and zinc. N-Nitrosodiphenylamine was the sole priority 3 chemical. The greatest concentration of PCBs in Segment 3 was in the southwest portion of the segment adjacent to Segment 2. Arsenic and zinc were also greatest in this portion of the segment.

The concentrations of chemicals in Segment 3 were much lower than in the other segments, and the elevations above reference were insignificant when compared with those for other segments in the waterway and the rest of Commencement Bay.

Sediment trap data were collected at one station by Norton and Barnard (1992) in this segment. The station was located near the Lincoln Street drain. For metals, no differences between present and historical data were observed; for organics, LPAH concentrations were higher in the trap sediment than in older sediment. The only priority chemical that exceeded the SQO in both bottom and trap sediment was total PCBs. While not identified as a problem chemical in the RI in segment 3, bis(2-ethylhexyl) phthalate was found at a concentration greater than the SQO. Benzoic acid was the only non-priority chemical that exceeded its SQO value in the trap. Norton and Barnard (1992) recommended that no additional source control efforts be conducted in this segment.

Of the 14 drainage pipes in segment 3 (TPCHD 1988), one is an NPDES permitted discharge (Buffelen Woodworking Co.). Two of the three seeps discussed by Coffey (1992) are adjacent to non-permitted discharge pipes. Two boat ramps are also located in the segment, one on each side of the segment.

Industries in the segment that could release chemicals to the waterway include Sound Refining Co., the Cascade Timber yard, Buffelen Woodworking Co., Hydro Systems Engineering, Modutech Marine, Knapp Boatbuilding, U.S. Gypsum, Murray Pacific Yard #1, and the Cenex Feed Plant.

4.3.2.4 Segment 2

The Priority 1 chemical identified in the RI in this segment was total PCBs. Priority 2 chemicals were HPAH, nickel, arsenic, and tetrachloroethane. Historical data in the RI indicated that intertidal sediments were also impacted by mercury, copper, zinc, and lead. Eight chemicals or chemical classes were included in the Priority 3 group: hexachlorobutadiene, chlorinated benzenes, phthalate esters, phenol, benzyl alcohol, dibenzothiophene, methylphenanthrenes, and methylpyrenes.

PCBs, HPAH, and arsenic were selected as indicator chemicals for the entire head of the waterway because their ratio of observed concentration to long-term cleanup goal was higher over a greater area than was true for other priority chemicals. PCBs were distributed over the entire segment. In the FS, the highest concentrations (2 to 14 times the cleanup goal) occurred along the southern shoreline near the turning basin; the minimum occurred along the northeastern shoreline of the turning basin. The station with the minimum was not sampled as part of the RI, but represented sediment surveys that occurred between 1979 and 1981. In the single subsurface core sample collected in the entire segment during the FS, PCBs appeared to occur primarily in the uppermost 6 inches of the sediment column.

The areal extent of HPAH contamination was not as large as that for PCBs; the area of greatest concentration occurred in the southeast portion of the segment. Elevations ranged from 1.1 to 1.8 times the cleanup goal. Within the one subsurface sediment core, HPAH concentrations were highest (3 times the cleanup goal) at a depth of about 18 inches.

Concentrations of arsenic exceeded the long-term cleanup goal primarily in the southeast portion of the segment and in the turning basin located mid-segment. Concentrations ranged from 1 to 2.6 times the cleanup goal. Based on the one sediment core, arsenic concentrations were highest (2.4 times the cleanup goal) at a depth of about 6 inches.

Norton and Barnard (1992) positioned two sediment trap stations in Segment 2, one at roughly each end of the segment. At the station near the east side of the segment, very little change was evident between present and historic concentrations of metals or organic chemicals. However, at the station near the west end of the segment, arsenic, LPAH, HPAH, and phenol concentrations were higher in the trap sediment than in the historic bottom sediment. Total PCBs in historic bottom sediments and in trap sediments exceeded SQOs at both stations. At the eastern station, bottom sediments exceeded the SQO for arsenic and zinc, and trap sediments were greater than the SQO for arsenic. At the western station, bottom sediments exceeded the SQO for hexachlorobenzene, while trap sediments exceeded the SQO for arsenic, LPAH, HPAH, phenol, and bis(2-ethylhexyl)phthalate.

Eighteen drains or pipes that discharge into Segment 2 were identified by TPCHD (1988) and discussed by Coffey (1992), including the NPDES permitted outfall for Elf Atochem North America, the Morningside ditch, and the East Channel Ditch. Groundwater seeps were noted on the southwest shoreline adjacent to the East Channel Ditch (Coffey 1992).

Major industries located along the waterfront in the segment include Hylebos Marina, Hylebos Boat Haven, Jones Chemical, General Metals of Tacoma, Elf Atochem North America, and U.S. Gypsum.

4.3.2.5 Segment 1

Segment 1 is located at the head of the waterway. Priority 1 chemicals detected during the RI/FS were HPAH, arsenic, and zinc. Priority 2 chemicals were phenol and tin. Six chemicals or classes of chemicals were identified as Priority 3 chemicals: phthalate esters, ethylbenzene, tetrachloroethane, xylenes, 1-methyl-(2-methylethyl)benzene, and the methylpyrenes. The indicator chemicals for the segment were defined in the FS as PCBs, HPAH, and arsenic. The similarity in concentration and distribution of priority chemicals in Segments 2 and 1 led to combining the two segments into the head of Hylebos Waterway problem area defined in the RI/FS and ROD documents.

The problem chemicals appear to occur primarily in the northwest portion of the segment. Here, HPAH concentrations ranged from 1 to 2 times the cleanup goal in surface sediment; subsurface maxima, based on one subsurface core sample, occurred just below the surface at a depth of about 6 inches.

The RI also identified arsenic at levels above the cleanup goal (1 to 3.2 times the goal) over most of the segment, except in a narrow band in the middle of the segment against the south shoreline. The highest concentration occurred along the eastern end of the waterway. Two subsurface maxima were observed in the one core sample. The shallower and smaller peak ($\sim$1.8 times the cleanup goal) occurred at a depth of about 10 inches. The larger peak (maximum of 1.9 times the cleanup goal) occurred at a depth of about 18 inches, and extended to a depth of about 50 inches.

Norton and Barnard (1992) set one sediment trap in Segment 1. It was located at the east end of the upper turning basin, close to Hylebos Creek. Arsenic, copper, zinc, HPAH, and LPAH were found in greater concentrations in the trap sediments than in the historic bottom sediment. Sediment samples taken at the time the traps were in place indicated that arsenic and PCBs were present in the surface sediment at concentrations exceeding the SQOs. These same chemicals were found in the trap sediments also at concentrations exceeding the SQOs. Benzoic acid was the only non-priority chemical that exceeded its SQO.

As of 1988, 17 pipes or discharges were identified by the Tacoma-Pierce County Health Department in Segment 1. One of these discharges is the NPDES-permitted outfall for Kaiser Aluminum & Chemical Corp., which is one of several discharges into the Kaiser Ditch. Two boat ramps and the Tacoma Boatbuilding Company are also present in Segment 1.

Major industries located along the waterfront in the segment include Tacoma Boatbuilding Company, Inc., Manke Lumber Company, Inc., Marine Metals Manufacturing, Jones-Goodell Corporation, Upper Hylebos Property 50 (Puyallup Tribe), Streich Brothers, Pederson Oil, Republic Supply Co., Wasser-Winters, Louisiana Pacific Corp., Lone Star Industries, Kaiser Aluminum & Chemical Corp., Bonneville Power Administration, City of Tacoma-Public Utilities, and the Weyerhaeuser Company. Storm drains may also release chemicals with the potential to impact sediments.

4.4 PROJECT DESIGN

4.4.1 Types of Sediment Samples

Pre-Remedial Design will involve collection of three types of sediment samples:

- Subtidal sediment cores will be collected to generate physical, chemical, and limited toxicity data to describe subsurface sediment quality.

- Subtidal surface grabs will be collected to generate physical, chemical, and limited toxicity and benthic infauna data on subtidal surface sediment quality.

- Shallow intertidal surface hand-cores will be used to collect physical, chemical, and limited toxicity and benthic infauna data on intertidal surface sediment quality.

4.4.2 Types of Physical, Chemical, and Biological Analyses

A variety of analyses will be conducted during pre-remedial design depending on the objective of the sampling event. Analyses of sediment quality will be conducted under a tiered approach with chemical data being generated first. Based on the chemical results, the HCC can elect, with EPA approval, to not complete biological testing and accept the chemical results for evaluation. Alternatively, the HCC may elect to conduct biological analyses to clarify the chemical results. Per the requirements of the AOC/SOW, the HCC will provide laboratory chemical data to EPA within seven days after receiving the last data package from the laboratories, and will coordinate with the EPA Project Coordinator in the selection of samples for biological analysis.

Physical analyses may include sediment grain size, Atterberg limits, specific gravity, and gravimetric water content. Sediment grain size and percent water will be determined for all core and surface sediment samples submitted for analysis. The remaining physical analyses will be conducted on up to 40 core samples that are selected to provide a general coverage of the waterway. These additional analyses will provide preliminary engineering data.

Chemical analyses may include the conventionals, metals, and organic compounds required by the Commencement Bay Record of Decision (EPA 1989), the Washington State Sediment Management Standards (SMS) (WAC 173-204), and PSDDA. Contaminant mobility tests will include leach tests, standard and modified elutriate tests, column settling tests, and porewater tests.

The HCC may elect to have sediment core samples that are between PSDDA SL and ML values undergo biological testing using the 10-day amphipod, sediment larval, saline Microtox and 20-day *Neanthes* biomass tests. If so, these tests would be conducted and evaluated according to PSDDA protocols. The tests would be conducted as part of Sampling Event 1A (see below).

Biological testing for subtidal surface and intertidal samples may also be performed to clarify chemical data. The HCC may elect to have stations with chemical values between the SQO and the 2LAET undergo this biological testing during Sampling Event 1C. In this case, both sediment toxicity (i.e., 10-day amphipod, sediment larval, and 20-day *Neanthes* growth tests and benthic infaunal analyses would be conducted. Sediment toxicity tests would be conducted and evaluated according to PSDDA protocols. If proposed, protocols for benthic infaunal analyses would be presented in the SAP Addendum for Sampling Event 1C.

4.4.3 Round 1 Sampling Events

Round 1 consists of three sampling events. Sampling Event 1A will focus on subtidal subsurface cores and subtidal surface grabs. Sampling Event 1B targets intertidal areas. Sampling Event 1C will fill data gaps generated by Events 1A and 1B as well as to develop preliminary data on contaminant mobility. Table 1 shows the level of effort assumptions that were used in developing the EPA SOW and associated schedule. It is provided as a general framework of the pre-remedial design program.

Data from Sampling Events 1A and 1B will be evaluated to determine whether an expedited cleanup of the Hylebos Waterway, utilizing the Slip One site for disposal of impacted sediments, is feasible. If appropriate, an expedited action proposal may be submitted to EPA during the first quarter of 1995. An expedited action proposal may result in amendments to the AOC/SOW, the work plan, and this SAP/QAPP. If an expedited action proposal is approved by EPA, the work conducted during Sampling Events 1B, 1C, and Round 2, which are discussed below, may be amended.

The scope of each Round 1 sampling event, including the types of samples that may be collected and type of analyses that may be performed, is presented below. Specific information on Sampling Event 1A is provided below and in Section 6.8. Specific information on the other sampling events will be provided in their respective SAP addenda.

<u>4.4.3.1 Sampling Event 1A</u>

As stated in the work plan, objectives for Sampling Event 1A are:

- Evaluate the physical nature of the sediment along the waterway
- Evaluate the vertical and horizontal distributions of chemicals in the surface and subsurface subtidal sediment
- Identify areas and volumes of sediment which will probably be dredged as part of the remedial action.

These objectives will be met through the acquisition of subtidal subsurface sediment physical, chemical, and biological data and subtidal surface sediment chemical data at 58 stations (see Section 6.8). Subtidal subsurface samples will be collected using an impact core (see Section 6.4.3.1) while subtidal surface samples will be collected with a van Veen grab (see Section 6.4.3.3). Analyses on subtidal core samples will include conventional physical parameters, engineering physical parameters (on up to 40 samples), project chemicals of concern, and PSDDA bioassays (i.e., 10-day amphipod, sediment larval, 20-day *Neanthes* growth, and saline Microtox) on select core samples that have chemical concentrations between SL and ML. Analyses on surface samples will include conventional physical parameters and project chemicals of concern. Biological testing of select subtidal surface sediments where chemical concentrations are between SQO and 2LAET may be conducted during Event 1C if this additional information is needed to evaluate potential remedial options. The data generated during Event 1A will also be used as a PSDDA partial characterization.

4.4.3.2 Sampling Event 1B

As stated in the work plan, the objectives of Sampling Event 1B are:

- Identify intertidal sediments that may require remediation
- Identify sediments or anthropogenic materials which may be sources of chemicals of concern to waterway sediments.

These objectives will be met through the evaluation of intertidal data gathered during Sampling Event 1B. Intertidal sediments will be collected from 50-70 sampling areas using a hand core, composited within the individual sampling areas, and analyzed for conventional physical parameters and project chemicals of concern. Biological testing of select subtidal surface sediments where chemical concentrations are between SQO and 2LAET may be conducted during Event 1C if this additional information is needed to select the preferred remedial option. Specific details of this sampling event will be provided to EPA in the SAP addendum for Event 1B which is due to EPA May 15, 1994.

4.4.3.3 Sampling Event 1C

As stated in the work plan, there are six objectives of Sampling Event 1C. Each objective may require its own types of samples or analyses. The objectives, and associated sampling and analysis regimes, are presented below. Additional details will be provided in the appropriate SAP addenda.

Objective 1: Complete additional sampling and analysis of subtidal surface sediment as needed to fill surface sediment quality data gaps in those areas of the waterway which might not be dredged.

Subtidal surface samples would again be collected using a van Veen grab. It is anticipated that conventional physical parameters and project chemicals of concern would be analyzed on these samples. Additionally, biological testing (i.e., 10-day amphipod, sediment larval, 20-day Neanthes growth, and benthic infauna) may be undertaken at stations sampled in Event 1A where surface sediment chemical results were between SQO and 2LAET if these analyses are required to select the preferred remedial option. The sampling intensity and proposed analyses to meet this objective will be presented in the SAP addendum for Event 1C which will be provided to EPA in the first quarter of 1995.

Objective 2: Complete biological testing, if required, on intertidal surface sediment.

Additional intertidal samples may be needed to fill data gaps following Event 1B. Intertidal samples would be collected using the same methods used in Event 1B. It is anticipated that conventional physical parameters and project chemicals of concern would be analyzed on the composite intertidal samples. Additionally, biological testing (i.e., 10-day amphipod, sediment larval, 20-day Neanthes growth, and benthic infauna) may be undertaken if these analyses are required to select the preferred remedial option. The sampling intensity and proposed analyses to meet this objective will be presented in the SAP addendum for Event 1C which will be provided to EPA in the first quarter of 1995.

Objective 3: Fill data gaps identified by the results from subsurface sediment sampling and analysis from Event 1A.

If there are data gaps in the subtidal subsurface data following Event 1A, additional cores may be collected using methods consistent with Event 1A. Analyses on subtidal core samples would include conventional physical parameters, engineering physical parameters (on select samples), project chemicals of concern, and PSDDA bioassays (i.e., 10-day amphipod, sediment larval, 20-day *Neanthes* growth, and saline Microtox) on select core samples that have chemical concentrations between SL and ML. The sampling intensity and proposed analyses to meet this objective will be presented in the SAP addendum for Event 1C which will be provided to EPA in the first quarter of 1995.

Objective 4: If natural recovery is proposed for areas of the waterway, develop the information and arguments supporting the proposal.

Based on the results of Sampling Events 1A and 1B, certain areas of Hylebos Waterway may be candidate areas for natural recovery. Candidate areas will be preliminarily identified as areas with surface sediment chemical concentrations that exceed SQO but are less than 2LAET. At present, the need for and scope of a sampling effort to support proposing areas for natural recovery is unknown. In the event that potential natural recovery areas are identified during the evaluation of Event 1A and 1B data, then a sampling program may be identified for Event 1C that provides additional information to support proposing the areas as natural recovery areas. This information would be provided in the SAP addendum for Event 1C.

Objective 5: Conduct a preliminary assessment of chemical mobility in sediments.

Subtidal subsurface cores, collected using the impact core, will be taken for preliminary contaminant mobility studies. It is anticipated that cores from 5-10 stations will be composited into 3 samples for analysis of contaminant mobility. The analyses that will be conducted include leach tests, standard and modified elutriate tests, column settling tests, and porewater tests. The stations that will be included in the contaminant mobility testing will be presented in the SAP addendum for Event 1C.

Objective 6: Collect additional sediment data, if needed, to assess the potential for sediment recontamination.

If the sediment data collected during Events 1A and 1B are not considered sufficient to assess the potential for sediment recontamination as defined in the Work Plan, Section 2.5, then additional sediment sampling will be recommended as part of the 1C SAP addendum. The scope and rationale of the additional data collection, if needed, including locations of samples, types of analyses and evaluations, and evaluation criteria will be included in the Event 1C SAP addendum.

4.4.4 Round 2 Sampling

As stated in the work plan, the objectives for the Round 2 sampling event are:

a) Collect data to fill the data gaps identified in the Round 2 Sampling and Analysis addendum to the SAP

b) Collect data to characterize the proposed disposal sites and capping materials to the degree necessary for the selection of the remediation plan

c) Collect data to evaluate whether the dredging and dredged material disposal operations can be designed to meet applicable effluent and water quality standards

d) Collect data to evaluate whether the discharge of dredged or fill material into the aquatic ecosystem can be designed to comply with CWA Section 404 and to support CWA Section 404(b)(1) analysis of the recommended remediation plan

e) Collect data for a preliminary assessment of the habitats in the areas affected by the recommended remediation plan

f) Collect data to evaluate the behavior of dredged material relevant to the selected confinement options, including an evaluation of the potential chemical migration pathways and of the potential for short and long term water quality impacts

It is not possible at this time to anticipate the types and numbers of analyses that will be required in Round 2. However, it is anticipated that the types of sampling and analysis programs in Round 2 will be similar to those shown above for Sampling Events 1A, 1B, and 1C. Specific information on Round 2 sampling will be provided in the Round 2 SAP addendum.

4.4.5 Quality Control Requirements

Quality control requirements will be instituted during sampling (Chapter 6), laboratory analysis (Chapter 7), and data management (Chapter 8) to ensure that the data quality objectives presented in Chapter 5 are met. Examples of field quality control requirements include conducting field audits and generating blind field samples and field replicates (see Section 6.1). Chemical laboratory quality control requirements are extensive and include the analysis of matrix spikes and matrix spike duplicates, certified reference materials, blanks, and surrogates (see Section 7.1.2). Quality control requirements for toxicity testing include the use of positive and negative controls and reference sediments (see Section 7.3); those for the identification of benthic infauna include the re-sorting of samples and the independent taxonomic review of 5 percent of the samples. If quality control problems are encountered, they will be brought to the attention of the EPA Project Coordinator. Corrective actions, if appropriate, will be implemented to meet the project's data quality objectives (see also Sections 7.1.10, 7.3.5, and 7.4.8).

4.4.6 Project Schedule

The projected schedule for pre-remedial design is shown in Figure 8. It was developed from the AOC/SOW (EPA 1993). The schedule is based on the levels of effort identified in Table 1A of the SOW which is provided in this report as Table 1. An additional 45 days was added to the Event 1A data report to enable the subtidal surface chemistry data, scheduled in the AOC/SOW for analysis and reporting during Event 1C but proposed herein for Event 1A, to be integrated with the subtidal coring data for the Event 1A data report.

5.0 DATA QUALITY OBJECTIVES

The qualitative data quality objectives (DQO) of the Hylebos Waterway Pre-Remedial Design program are stated in the discussion of the program and quality assurance objectives of this document (Section 4.1). Care must be taken to ensure that the accuracy and precision of the data will enable detection of chemical concentrations above those found in the naturally variable environment. To ensure that these data are sufficient to meet both qualitative and quantitative DQOs, full data packages that satisfy Puget Sound Dredged Disposal Analysis (PSDDA) QA2 data reporting requirements will be required as deliverables. These deliverables will be reviewed and validated by the QA manager for analytical chemistry.

The data quality parameters to be discussed in this section are precision, accuracy (bias), representativeness, comparability, and completeness (PARCC).

5.1 PRECISION

Precision is defined as the degree of agreement between or among independent, similar, or repeated measures. While true precision cannot be measured, it can be expressed in terms of analytical variability. In this program, analytical variability will be measured as the relative percent difference or coefficient of variation between analytical lab replicates and between the matrix spikes and matrix spike duplicate analyses.

5.2 ACCURACY

Accuracy is the amount of agreement between a measured value and the true value. It will be measured as the percent recovery of matrix spikes, matrix spike duplicates, organic surrogate compounds, and any standard reference materials. Additional bias will be characterized during chemical analysis of blank samples (e.g., method and field blanks).

5.3 REPRESENTATIVENESS

Representativeness is the degree to which sample results represent the true system. This component is generally considered during the design phase of a program. This program will use the results of all analyses to evaluate the data in terms of its intended use. Bias built into the experimental design includes the use of a single station to characterize the site. The collection of blind field samples and blind field replicates at approximately 5 percent of the stations and the use of method blank analysis will measure but not eliminate this bias.

5.4 COMPARABILITY

Comparability is the degree to which data from one study can be compared with data from other similar studies. The results from the Hylebos Waterway Pre-Remedial Design study will be comparable with other studies in Commencement Bay and in other areas of Puget Sound. Studies with comparable methods and quality control requirements are the baseline study for the U.S. Navy Homeport Project, the Puget Sound Dredged Disposal Analysis Baseline Study, the Marine Sediment Task of the Puget Sound Ambient Monitoring Program, and the Sitcum Waterway Pre-Remedial Design Study. Past Puget Sound studies using comparable methodologies include the Elliott Bay and Everett Harbor Action Program studies, the Commencement Bay Remedial Investigation/Feasibility Study, and the EPA Region X, 1988 Reconnaissance Survey. The PSDDA disposal site monitoring program should also be comparable.

One of the primary objectives of sediment characterization for this study is to determine whether Sediment Quality Objectives (SQOs) are exceeded. Comparison of analytical chemistry data to the SQOs requires that the methods and procedures used during pre-remedial design are sufficient to reliably distinguish *in situ* chemical concentrations from native sediment concentrations, and to allow comparison to the SQOs. Required detection/quantitation levels and those analytical methods necessary to achieve data comparability are presented in Tables 6 and 7.

5.5 COMPLETENESS

Completeness is the amount of data obtained during a project compared to the amount of data expected. Since the amount of sediment that will be collected to measure each parameter exceeds that required for the analysis, approximately 100 percent completeness is expected. The volume of sediment to be collected will be sufficient to reanalyze the sample should the initial results not meet QC requirements. The target goal for completeness for this project is 90 percent.

6.0 FIELD SAMPLING PLAN

The following field sampling plan contains methods for collection of all sample types anticipated during Pre-Remedial Design. Section 6.8 contains information specific to Sampling Event 1A because it is the first scheduled sampling event. Prior to the initiation of each of the other field events, a SAP/QAPP addendum will be prepared for review and approval by EPA. The types of information that will be provided in the SAP/QAPP addenda include sampling locations and associated rationale; sample designators; and boring numbers, core sections, and lengths of borings at each boring location for those sampling events that involve collection of sediment cores. The addenda will also include any changes to the sampling, analysis, or quality assurance procedures presented in this document.

6.1 BACKGROUND INFORMATION

6.1.1 Chemical Accumulation in Sediment

The primary sources of chemicals to the sediments of Hylebos Waterway have been identified in the RI/FS as industrial discharges (point and nonpoint), surface runoff, and storm drains. The mechanisms by which chemicals accumulate in sediment, and the related sampling considerations, are described below. Groundwater sources of sediment chemicals are discussed separately at the end of this section.

Chemicals are Sediment Bound: Chemicals which have a high affinity for soil may bind to the solids in the water column and settle to the bottom of the waterway. Water soluble compounds may dissolve into the receiving water and not accumulate in the sediment to a great degree.

Chemicals Accumulate in Recent Surface Sediment: The above mechanism results in chemicals accumulating in the recent surface sediment above the native sediment in the waterway. Since the compounds which are bound to the sediment are relatively insoluble, there is little migration of chemicals from the sediment to the overlying water. Surficial sediment can also be mixed a few feet deeper into the underlying sediment by mechanical action (ship traffic) and biological mixing (bioturbation). It can also be buried by the deposition of new sediment. Consequently, the maximum depth of impacted sediment in a waterway generally matches the extent of recent sediment accumulation above the original native sediment in the waterway, with a foot or two allowance for mixing. The surface of the native sediment can be estimated by mapping the deepest known depth of the waterway from historical bathymetry maps. The thickness of recent sediment can then be calculated by comparing the current bathymetry to the deepest historical bathymetry of the waterway.

Isopach Maps Indicate Contamination: The extent of sediment accumulation in the waterway over the life of industrial discharges has been estimated and mapped as isopachs (Figures 5a-c). Isopach maps show the contours of the thickness of sediment accumulated above the deepest historical known depth of the waterway. They are based on the difference between the 1993 bathymetry of the waterway, and the deepest measured bathymetry of the waterway from Corps of Engineers post dredging surveys which occurred from 1931 through 1971 (the last Corps dredging of the waterway). Thousands of depth soundings are collected for each major bathymetry survey, forming a significant data set on which to establish the isopachs. Past experience with other Puget Sound ports shows that isopach maps are a good indicator of the location of impacted sediments. The isopach maps indicate that there has been relatively little (< 2ft) accumulation of sediment in the navigation channel, slightly more accumulation in the turning basins (generally < 4ft), and the greatest accumulation outside of the navigation channel (generally <10ft). The thickest accumulation (15 - 30ft) appears to be at the head of Hylebos Waterway where Hylebos Creek discharges into the waterway. In general, the isopach maps are likely to be accurate to roughly a foot in the navigation channel, and within two feet outside of the navigation channel. Since post-dredge surveys are generally not available for areas of private dredging, the isopach maps are based on a later Corps condition survey, with the isopach maps being less accurate at those locations.

Groundwater Contamination: Groundwater seeps have been identified as potential sources of chemicals to the waterway. In situations where groundwater is acting as a source, the discharge impacted sediment may not be limited to the recently accumulated sediment, but may extend into the underlying native sediment.

6.1.2 Sampling Considerations

Area and Volume: The isopach maps provide a good indication of the location and depth of sediments which may have been impacted by discharges, and which will be sampled to evaluate the need for remedial action. Sediment cores will be placed to sample the full depth of the accumulated sediment indicated by the isopach maps, and will extend into the underlying native sediment. Since thousands of data points already exist on the thickness of accumulated sediment (bathymetry surveys), the number of cores needed to map the extent of contamination can be limited to the areas of accumulation shown by the isopach data set. Fifty-eight core locations have been identified for Sampling Event 1A to complete this objective. Data gaps identified from evaluation of the resulting core data will be filled during Sampling Event 1C.

Sediment chemistry, and toxicity on selected samples, will be measured in both the recently accumulated sediment as well as the underlying native sediment at selected stations. The analytical data, in combination with the isopach maps, will be used to tentatively identify areas of the waterway and associated volumes of sediment that may be permitted for open water disposal, that may require active remediation, and that have the potential to recover naturally (i.e., surface is $>$SQO and $\leq$2LAET).

Groundwater Sources: During Sampling Event 1A, sediment cores will be placed in representative areas of suspected ground water contamination. The chemistry of the native sediment will be evaluated and compared to native sediment chemistry from areas without groundwater sources to determine the impact of groundwater sources on sediment quality. Data gaps indicated by the evaluation will be addressed as part of Sampling Event 1C.

Surface Sediment Quality: Surface grab samples will be collected throughout the waterway to evaluate the current sediment quality with respect to the SQOs. During Sampling Event 1A, surface sediment samples will be collected in the vicinity of the cores to identify surface areas which may require remediation. During Sampling Event 1B, surface samples will be collected in nearshore areas to identify surface areas which may require remediation, and sediments or anthropogenic materials which may be sources of chemicals of concern to waterway sediments. Sediment chemistry will be measured and compared to the SQOs. Data gaps indicated by the evaluation will be addressed during Sampling Event 1C.

6.2 SAMPLE TYPES

6.2.1 Samples Collected For Chemical Analysis

Field samples will be collected at each of the identified sampling locations. These samples will be used to determine distributions of chemicals of concern.

At approximately 5 percent of the stations, two blind field replicates for chemical analysis will be collected. Blind field replicates are additional samples collected at a station to enable statistical analysis of the resulting data. Their origin is not revealed to the laboratory (hence the term blind). They will be generated by collecting new sediment at the sampling location, not by subsampling composited and homogenized sediment. These data will be used to determine natural variability associated with the environment and laboratory operations.

Blind field sample splits will also be generated at the same stations as the blind field replicates. These samples will be taken from the same composite sample as the field sample. The resulting data will provide information on the variability associated with sample handling and laboratory analysis operations.

Introduction of chemical contaminants during sampling and analytical activities will be assessed by the analysis of blanks. Rinsate blanks, consisting of sampling equipment rinsates, will be generated for all chemical parameter groups at approximately 5 percent of the stations and submitted for analysis to the laboratory.

The blind field sample splits, blind field replicates, and rinsate blanks will be collected at the same stations, thus maximizing the amount of information available to distinguish laboratory and environmental variability. They are more fully described in Section 7.1.3.3.

6.2.2 Samples Collected For Sediment Toxicity Testing

Samples retained for toxicity testing will be from the same composite field sample as is used for chemical analysis. Additional field replicates will not be collected for toxicity testing.

6.2.3 Samples Collected For Benthic Infauna Assessment

Samples may be collected from select subtidal and intertidal stations for benthic infaunal analysis during Event 1C. The selection of stations for benthic studies will be based on the results of Events 1A and 1B (see Section 4.4.2). These stations and the analysis procedures will be reported in the Event 1C SAP Addendum.

6.2.4 Samples Collected For Contaminant Mobility

The preliminary estimate in the SOW assumes that each contaminant mobility sample will be collected from two to four stations within Hylebos Waterway during spring 1995. The exact number and location will be decided following receipt of the results of the 1A subsurface sampling.

A minimum of 6 liters of sediment is required from each station for the sequential batch leach tests, column leach tests, and porewater extraction tests. Each column settling test will require 20 liters of sediment, and the elutriate tests will require at least 3 liters for either the standard or modified tests. Each elutriate test also requires collecting 20 liters of uncontaminated site water, and the column settling test will require collecting approximately 80 liters of site water.

6.3 SAMPLING LOGISTICS

6.3.1 Sampling Vessels

A variety of sampling vessels will be used on Hylebos Waterway during pre-remedial design field activities. The following discussion addresses available vessels. The vessel(s) selected for each sampling effort will depend on the type of sampling and the availability of the vessel(s). The actual vessels selected for Sampling Event 1A are discussed in Section 6.8 (Specific Information For Sampling Event 1A). Information on vessels to be used during the other sampling events will be presented in the appropriate SAP/QAPP addenda.

6.3.1.1 Sediment Coring

During sediment coring operations, the vessel owned and operated by Underwater Specialists, Inc. will be used. This vessel has a 55-foot double-pontoon hull and twin diesel engines. It has been outfitted to accept the impact coring system operated by Mr. Bill Jaworski of Marine Sampling Systems.

If conventional hollow stem drilling is necessary, either a barge will be used as the sampling platform and a drilling rig driven onto the barge, or self-propelled drilling equipment will be used. Use of this equipment is anticipated only if needed during pre-remedial design to collect data during Event 1C or Round 2 to support selection of the preferred remedial option.

6.3.1.2 Subtidal Grab Sampling

The R/V Kittiwake, owned and operated by Mr. Charles Eaton of BioMarine Enterprises, will be used during grab sampling operations for Sampling Events 1A and 1C. The R/V Kittiwake is 42 feet long, with a beam of 11 feet and a draft of 5.5 feet. It was built to Mr. Eaton's specifications for research use. It has a hydraulic winch system that is capable of deploying samplers to any depth in Puget Sound. It carries a full complement of electronics, including a chart-recording fathometer, RADAR with a variable range marker, Loran-C, and a global positioning system (GPS). The R/V Kittiwake has been used for nearly all of the major grab sampling programs in Puget Sound over the last decade.

6.3.1.3 Intertidal Sampling

Intertidal sampling will be accomplished by field crews using small boats (i.e., less than 15 feet long) and possibly the R/V Kittiwake. The small boats will run the field crews from the R/V Kittiwake or a shore station to the sampling locations for collection of the samples. The field crews will return with the sediment samples to the R/V Kittiwake or the shore station, where processing for chemical, and perhaps toxicity testing and benthic infauna, will occur.

6.3.2 Field Personnel

The composition and size of the field crew will depend on sampling objectives. However, every field crew will include the following individuals: site safety officer, cruise leader, and field staff.

The site safety officer will have the following responsibilities:

- Correct any work practices/conditions that may result in personnel injury or exposure to hazardous materials
- Determine personal protection levels and necessary clothing/equipment, and oversee its proper use
- Verify that the field crew are aware of the provisions of the health and safety plan and instructed in safe work practices
- Verify that the field crew has received the required safety training

The cruise leader is responsible for adherence to the SAP/QAPP, decisions that involve changes to the SAP/QAPP, cruise preparation, mobilization, sample custody, and chain-of-custody.

The field staff will assist in sample collection, handling, and storage. They will maintain the field sampling logs and notebooks, and will be responsible for properly labelling containers for storage of chemical, toxicity, and benthic infauna samples.

6.3.3 Field Logbook

The field logbook will be a bound document containing individual field and sample log forms. Information will include personnel, date, time, station designation, sampler, types of samples collected, and general observations.

6.3.4 Sample Designations

Sample designations will be developed from format requirements of the data management system. Each station designation will reflect station number and sampling event. Sample designations for sampling events not presented in the SAP/QAPP (Section 6.7) will be presented in the appropriate SAP/QAPP addendum.

6.3.5 Sample Collection Checklist

A sample collection checklist will be produced prior to sampling and completed following sampling operations at each station. The checklist will include station designations, types of samples to be collected (e.g., one jar for metals, three 2-liter jars for bioassays), and whether blind field samples and blind field replicates are to be collected.

6.3.6 Equipment and Supplies

During mobilization, all required field equipment and supplies will be loaded onto the appropriate sampling vessel. Equipment and supplies will include, in general, sampling equipment (e.g., positioning equipment, samplers, core tubes, sieve boxes), utensils, decontamination supplies, sample containers, coolers, logbooks, personal protection equipment, and personal gear.

6.4 SAMPLING PROCEDURES

6.4.1 Station Positioning Procedures

Two different navigation and station positioning systems were considered for application: differential global positioning (DGPS) and land surveyor-based theodolite with electronic distance measurement (EDM). The system selected for each sampling event will depend on the type of sampling and the availability of the equipment.

6.4.1.1 Differential Global Positioning

Differential GPS (DGPS) consists of a GPS receiver on the sampling platform and a differential receiver located at a horizontal control point. At the control point, the GPS-derived position is compared with the known horizontal location, offsets or biases are calculated, and the correction factors are telemetered to the GPS receiver located on the sampling platform. Differential GPS can provide accuracies on the order of ±1-5 meters. Positioning accuracies on the order of ±1-3 meters can be achieved by avoiding the few minutes per day when the satellites are not providing the same level of signal. The GPS system provides the operator with a listing of the time intervals during the day when accuracies are decreased. Avoidance of these time intervals permits the operator to maintain better positioning accuracy. Accuracy of ±1-3 meters is sufficient for sediment sampling events. The GPS receiver routes latitude and longitude to an integrated navigation system, which displays the platform's position in plan view. Navigation data such as range and bearing from the target sampling location are provided at a user-defined scale to guide the sampling platform's pilot to the desired location.

The advantages of DGPS are associated with its relative independence from shore support personnel. The DGPS navigation system can be installed on a small work boat for intertidal sampling activities or on a larger research vessel for subtidal sample collections. DGPS can support nighttime as well as daytime field operations.

6.4.1.2 Electronic Distance Measuring System

A land-based surveyor situated at horizontal control locations along the waterway's shoreline can offer location support to subtidal field operations using an electronic distance measurement device and a range-azimuth system (i.e., a surveying theodolite). Distances between the observation/sampling points and control reference points are measured using the EDM, while horizontal angles from established points and baselines are measured with a theodolite. The surveyor, through communications with the field sample collection team, may thereby direct the team to pre-established target locations or document observation and sampling locations occupied by the team. Horizontal coordinates are conveyed and identified as latitude and longitude (NAD 83) to the nearest 0.01 seconds for the field logs. The accuracy of the vertical component of station positioning, using a Lasertrack 5000, is about $\pm$ 0.5 ft based on a horizontal distance of 3,000 ft from the shore station to the sampling station.

The advantage of land-based surveyor support to achieve positioning is in its reliability and accuracy (i.e., less than 10 centimeters), which is appropriate for bathymetric surveys but is not required for sediment sampling. The principal disadvantages are its dependence upon surveyor access to shoreside locations within sight of the sampling activities and consequently its dependence upon daylight conditions with good visibility.

6.4.1.3 Vertical Positioning

Vertical positioning is required to establish the elevation of the sea bed at the subtidal sampling locations. Elevations will be established by measuring tide elevation, and at the same time measuring the vertical distance from the water line to the mud line at the sample location. The tide elevation will be established by measuring the distance to the water line from a known reference point, such as a positioning control point on the top of a dock. Depth to mud line will be obtained using a lead-line measuring tape. Vertical measurements will be recorded to the nearest 0.1 ft.

6.4.2 Equipment Decontamination Procedures

With the exception of new core tubes and the grab sampler, sampling equipment that contacts sediment samples will be decontaminated in the following manner prior to use at each station and between blind field replicates.

- Rinse with water provided by the sampling vessel
- Wash with brush and Alconox™ soap
- Double rinse with distilled water
- Rinse with 0.1 N nitric acid
- Rinse with deionized water
- Rinse with methanol

Decontamination of stainless steel bowls, utensils, core catcher and the intertidal sample corers (Sampling Event 1B) will be performed before sampling and between each composite sample. Sample handling equipment will also be wrapped in aluminum foil, with the dull side facing the equipment, following the methanol rinse. Before being used to remove sediment from the samplers, all equipment will be rinsed with deionized water. Disposable latex gloves will be rinsed with distilled water before and after handling each sample as appropriate, to help minimize sample contamination (to minimize phthalate ester contamination and contamination due to other chemicals associated with latex gloves). Rinse waters will be diluted with site water and discarded into the waterway.

New aluminum core tubes will be scrubbed with Alconox, rinsed, and wrapped immediately in aluminum foil to reduce the risk of contamination. A sufficient number of core tubes will be prepared in advance so that operations can continue should a tube become contaminated. The grab sampler will be scrubbed with Alconox and rinsed with site water between stations.

Sample containers and glassware for organics and metals analysis will be cleaned in the appropriate manner using the standard PSEP procedures (PSEP 1989a,b).

6.4.3 Sample Collection and Processing Procedures

Sediment sample collection during the pre-remedial design will be accomplished using three collection methods. The first is the collection of subtidal cores, using protocols and guidelines consistent with the Puget Sound Dredge Disposal Analysis program (PSDDA

1989). Sediment samples will be collected from the cores for chemical analysis and toxicity testing. The second element consists of the collection of subtidal surface grab samples, using protocols and guidelines consistent with the EPA's Puget Sound Estuary Program (PSEP) protocols and guidelines (PSEP 1986). Sediment samples for this element will be collected for chemical analysis and possibly toxicity testing and benthic infauna analysis. The third element is the collection of intertidal cores. Intertidal sediments will be collected using accepted methods (Gonar and Kemp 1978; Zeh et al. 1981; Hart-Crowser et al. 1991) and analyzed for sediment chemistry, toxicity, and benthic infauna.

During the sampling events, subtidal or intertidal obstructions may preclude collecting a sample. Attempts will be made to relocate the sample to an area that has comperable sediment accumulation and that is in the vicinity of the potential sources that would have been addressed by the initial location. The EPA Project Coordinator will be contacted, if available, regarding the proposed revised sampling location. If the EPA Project Coordinator is not available for immediate approval of the change, then the station will be relocated, sampled, and appropriately documented.

It is anticipated that EPA will request sample splits for chemical and perhaps biological analyses. It is recommended that EPA selects the same stations for split samples as those that will have blind field duplicates and blind field replicates prepared by the HCC.

<u>6.4.3.1 Subtidal Cores for Chemical and Toxicity Testing</u>

Subtidal cores will be collected during Sampling Events 1A and 1C.

Collection -

The isopach maps indicate that all Sampling Event 1A core locations will be less than 14 feet deep. An impact corer will be used for collecting cores up to 14 feet deep at all sampling locations. The impact corer offers a high rate of production, superior retention of shallow samples, and a greater sample volume compared to conventional drilling equipment. It also provides greater penetration capabilities than piston-type or conventional gravity corers when encountering native subsurface sediments such as those frequently underlying the surficial sediments in Hylebos Waterway.

The impact corer is not expected to reliably collect sediments located deeper than about 14 feet below mudline. It is anticipated that all subsurface sediment sampling for Round 1 can be collected by impact coring. If conditions are encountered which require cores beyond the capacity of the impact coring to select the preferred remedial option, a barge mounted drilling rig may be used during Event 1C or Round 2 to obtain sediments located below 14 feet.

1) **Impact Coring.** Sediment at each station will be sampled using an impact-type coring device (Figure 9) deployed from a self-propelled barge. The impact corer utilizes a hydraulic/pneumatic system to operate a hammer that drives a length of 4-inch O.D. aluminum tubing into the sediment. A continuous sediment sample is retained within the tubing with the aid of a stainless steel core cutter/catcher. There is no core liner.

The impact corer is equipped with a transducer mounted on the sliding hammer portion of the corer. This transducer can be used to measure penetration depth. A second transducer mounted directly above the core tube is able to determine the height of the sediment column within the core barrel under circumstances where sediment gases released into the core barrel above the sediments do not interfere with the acoustic reflection from the sediment surface within the core barrel. When there are differences between the two transducer readings, recovery can be estimated. The recovery estimate is used to accurately determine the true sample depth. During sediment investigations conducted for the construction of the carrier pier at the U.S. Navy Base in Everett, Washington, recovery ranged between 57 and 92 percent and averaged approximately 73 percent. Recovery information is used to determine the depth from which certain sediments were collected and the location of those sediments within the core barrel.

The number of blows of the hammer required to drive the core tube each 1-foot increment will be recorded on a strip chart recorder. The number of blows per foot provides a relative measure of sediment density, and an indication of a change in sediment type. For example, the soft surface sediment may have a penetration resistance of only one to five blows per foot, while the lower more dense alluvial sediment might have a penetration resistance of 10 to 30 blows per foot. The depth where the penetration resistance changes is typically indicative of a change of sediment type. The depth of this contact between layers will be recorded for each location, provided that the change is within the sampling capability of the equipment.

Core barrel penetration and the length of the sediment sample acquired during driving are monitored and the data transmitted to the vessel via an electric cable. Data are recorded on a strip chart recorder. The amount of sediment sample lost during extraction of the core from the bed is monitored by the internal transducer.

An example of an impact core log sheet containing the acoustic data is presented in Figure 10.

The planned core sampling depth for Event 1A is four feet beyond the depth of recent sediments as indicated on the isopach maps. If considerable resistance to driving is encountered at a shallower depth, then the coring will be stopped at that depth. If the sediment at the bottom of the core tube is not native, then an additional attempt will be made to drive a core into native sediment, to a maximum depth of fourteen feet, or until practical refusal is encountered.

The planned analysis of subsurface sediment composites for Event 1A includes chemistry, and may include bioassays of recent sediment if the chemical concentrations fall between the PSDDA SL and ML values. Bioassays are not planned for the native sediment. A minimum of 4 1/2 liters of sediment is needed to complete the chemistry and bioassays, without allowance for re-testing. Assuming 75 percent recovery in the core, as compared to the length driven, three feet of drive depth is required to obtain 4 1/2 liters of seidment. For surface composite locations where the isopach maps indicate less than three feet of native sediment, a second core will be driven to provide additional surface sediment for testing. Because of the cost of coring, and because of the screening nature of the Event 1A coring, double cores will not be collected where subsurface composites, based on the isopach maps, are less than three feet in drive length. This will result in a limited number of subsurface composites without sufficient sediment to complete a full suite of bioassays.

2) Auger Drilling. A barge-mounted hollow-stem auger may be used to collect sediment cores from depths beyond the capacity of the impact corer during later stages of the project but not during Event 1A. The hollow-stem auger uses a conventional rotary-type drill rig to collect undisturbed sediment samples using a piston-type, geologic undisturbed sampler (GUS). These samplers collect 24 to 36 inch long samples. In circumstances where sufficient sample volume for all testing requirements cannot be obtained from a single boring at each station, additional borings will be made at that station. No correction for sediment consolidation is made during drilling operations because samples are collected at 2 to 3 foot intervals based upon actual measurements of sediment depth prior to the collection of each sample. The potential for significant sediment consolidation, especially in a subsurface core, is reduced in a 2 to 3 foot-long core compared with the 14 foot barrel used for the impact coring operations.

Processing -

The following field and laboratory processing methods will be followed for environmental samples and blind replicate samples.

1) Field Processing of the Core. Sediment recovery measurements will be utilized to establish sections of the core which represent lengths that measure 4 feet *in situ*. The *in situ* depth to the top of the section will be recorded for each section. Before the tube is cut, a label identifying the station and core section will be securely attached to the outside of the casing at the top of each section, and wrapped with transparent tape to prevent loss or damage of the label.

Sediment at each end of each section of tube will be visually classified for qualitative sample characteristics. Changes from the top to the bottom of each section of the tube will be noted, and verified during laboratory classification. Visual classification information will be recorded on field logs for core sampling (Figure 11).

Following field classification, the core ends will be capped with aluminum foil and a protective cover to prevent leakage. The core sections will be stored in containers chilled with ice or "blue ice" to approximately 4°C. Containers with adequate size and capacity to handle 4-foot-long core sections will be used. Empty tubing will be removed to assure that each section is full of sediment. A full tube will limit the disturbance during storage and transport by eliminating the possibility of gross distortion of the sediment.

2) Laboratory Processing of Core Sections for Chemical and Toxicity Testing. Core sections will be extruded in the laboratory by elevating the tube at an angle and tapping the tube with a mallet, by using a core press, or by vibrating the core tube. This process leaves the core generally intact for visual classification of the sediments with depth.

Previous studies (Corps of Engineers 1984-5 and Hart-Crowser 1986) indicated a strong correlation between visual classification and sediment quality. These studies showed that the blackened organic surface sediment typically contained elevated chemistry, while the underlying gray sediment did not. Past experience in the Hylebos Waterway (Landau Associates, personal communication with Pete Rude, 3/94) confirms this correlation for the project site. Typically, the recent sediment in the waterway is a dark, soft fine-grained sediment with an abundance of organic material. There is generally a dramatic change to the native material, consisting of a lighter compact coarser-grained sediment without abundant organics. Past use of the impact core in Hylebos Waterway has indicated an abrupt change in penetration resistance as the native material is encountered, occasionally resulting in refusal to further penetration. Sediment recovery from impact cores in the waterway has been as high as 80 to 90 percent (i.e., 10 to 20 percent of the core has been lost during core retrieval). Sediment conditions have generally been as indicated by the isopach maps, with only a few feet of recent sediment encountered in the navigation channel, increasing to several feet along the toe of the waterway slope.
Once the sample is extruded in the laboratory, it will be visually classified by an experienced engineering geologist or geotechnical engineer working under direct supervision of Dalton, Olmsted & Fuglevand. This individual will look for the characteristics mentioned above, as well as penetration resistance data (blows per foot) from the impact coring, to establish the contact between potentially impacted and native sediment. The depth of each contact will be measured and recorded.

Each core sample will be visually classified prior to compositing. The following information will be recorded:

- Sample recovery
- Physical soil description
- Soil type, density/consistency, color
- Odor
- Visual stratification and lenses
- Vegetation
- Debris
- Biological activity (e.g., detritus, shells, tubes, bioturbation, live or dead organisms)
- Presence of oil sheen
- Other distinguishing characteristics or features.

3) **Sediment Compositing.** The compositing of sediment from sampling Event 1A will be vertical within individual cores, with no compositing of sediment from adjacent cores.

The purpose of Sampling Event 1A subsurface sampling is to characterize the areas and sediment volumes requiring remediation. Subsurface samples will be composited and analyzed in accordance with PSDDA procedures. The following guidelines form the basis of identification of samples for analysis for Sampling Event 1A coring.

Dredged Material Management Units: PSDDA identifies a dredged material management unit (DMMU) as the smallest volume of dredged material for which a separate disposal decision can be made (PSDDA 1989). The size of each DMMU is based on the cut depth at which dredging will be performed. PSDDA identified four feet as the typical cut of usually available dredging equipment and used four feet as the basis for defining the depth of DMMUs. PSDDA also established DMMU volumes for the purpose of sediment characterization, ranging from 4,000 c.y. for surface sediment (upper 4') of high concern, to 48,000 c.y. for surface sediment of low concern. Sediment in the Hylebos Waterway is currently categorized as high concern. Reliable calculations of the volume of sediment requiring remedial action have not yet been established, but rough estimates range from roughly 250,000 cubic yards to 1,000,000 cubic yards, which translates into 60 to 250 potential high ranked DMMUs.

PSDDA Sampling Requirements: PSDDA identifies two levels of studies. A full characterization (FC) is required for projects requesting a final decision regarding the acceptability of sediment disposal at a PSDDA open-water site. A partial characterization (PC) is intended to provide information to better characterize the nature of sediments before designing and implementing a FC. Depending on site conditions and complexity, the results of a PC can also be used to down-rank an area prior to full characterization. For a FC in a high ranked area, one sampling location and one analysis is required for each surface DMMU. This would equate to 60 to 250 samples for a PSDDA full characterization for the Hylebos Waterway, depending on the actual volume of sediment under consideration. A PSDDA partial characterization (PC) requires only ten percent (down ranking one level) to twenty percent (down ranking two levels) of the samples and analyses required for a FC, or only 10 to 50 samples. Sampling Event 1A is intended as partial characterization under PSDDA.

Compositing within a DMMU: The DMMU approach recognizes the common heterogeneity of chemical distribution in sediments. PSDDA evaluated a wide range of sampling strategies to address this condition and concluded that compositing of sediment samples from within a DMMU to establish average sediment quality conditions was the preferred way to characterize sediment to be dredged, rather than requiring a large number of samples to be analyzed individually (PSDDA 1989). For Event 1A, compositing will be vertical within an individual core, without compositing sediment together from adjacent cores since specific dredging objectives have not yet been established for the Hylebos Waterway. The length of composites from within a core will be generally four feet or less, except as specifically noted in cases of sampling efficiency, where composite lengths up to six feet will be used.

Compositing within Stratigraphic Units: Vertical compositing of sediment within a core will be limited to either recent sediment or native sediment. Composites representing recent sediment will be separate from those representing the native sediment, based on visual classification of the cores (described in Laboratory Processing of Core Sections, Section 6.4.3.1 Processing 2). The composite representing native sediment will not include the top foot of native sediment below the contact between the units because the top one foot of native sediment may be a transition layer impacted by overlying sediments.

Based on the above guidelines, individual samples were identified in the following manner:

- When the depth to native sediment is less than six feet, assign one composite to the recent sediment and one composite to the native sediment.

- When the depth to native sediment is between six feet and ten feet, assign two composites to the recent sediment and one composite to the native sediment.

- When the depth to native sediment is between ten and twelve feet, assign three composites to the recent sediment and one composite to the native sediment.

The general compositing strategy is shown in Table 8.

After the visual classification is complete, (see Laboratory Processing of Core Sections for Chemical and Toxicity Testing) the designated core subsections will be sampled for chemical and sediment toxicity analyses. The extruded core will be longitudinally split and samples immediately removed for total sulfides and volatile organics analyses. The immediate removal of these samples will minimize potential volatilization of the constituent compounds. Color photographs of the cores will be taken after subsampling for sulfides and volatile organics, and prior to compositing of the sediment.

The composite samples which are submitted for chemical analysis will also be tested for conventional parameters, including grain size distribution, total solids, total volatile solids, and total organic carbon. In addition, up to 40 discrete sediment samples will be collected and submitted for physical characterization (Atterberg limits, specific gravity, gravemetric water content, and grain size distribution) to provide basic engineering properties for later input into dredging evaluations. The discrete samples will be selected from the cores based on the following objectives, to the extent the objectives are not satisfied by the conventional testing on the composited sediment samples submitted for chemical analyses: 1) provide general geographic coverage of the sediment throughout the waterway, and 2) provide general coverage of the different sediment types encountered in the waterway. The selection of samples for physical testing will occur at the time of sample processing.

Sediment that is representative of the core will be removed and placed into an appropriately cleaned stainless steel bowl and homogenized to a uniform color and texture. Pre-labeled jars for chemical and toxicity testing will be filled with the homogenized sediment. Table 9 shows the numbers and sizes of the required sample containers, as well as method of preservation and holding times. At approximately 5 percent of the stations, rinsate blanks will be prepared during compositing and submitted to the laboratory for analysis.

Samples composited from cores for toxicity testing will be placed into 2-liter borosilicate glass jars with teflon-lined lids. To ensure that an adequate volume of sediment is available should re-testing be required, a total of 5 liters of sediment will be collected at each station. Six liters will be collected at stations with a high degree of fine-grained sediment. Care will be taken to ensure that no headspace remains in the top of the jar. However, where there is insufficient volume to fill a jar, or if sediment settling has occurred, those jars will be overlaid with nitrogen gas.

Sediment samples for grain size will be kept in a cool place. Samples for organics, metals, total organic carbon (TOC), sulfides, and bioassay analysis will be stored on ice at approximately 4°C until delivered to the laboratory for analysis. Samples for mercury analysis will be stored at 4°C and will be analyzed within 14 days.

6.4.3.2 Subtidal Cores for Contaminant Mobility

Sediments collected for contaminant mobility should maintain their original pore water as well as their physicochemical state. Sediment cores for contaminant mobility will be securely sealed both top and bottom to prevent loss of pore water, overlying water, or both. The bottom of the core will be sealed first and is best accomplished by using a tight-fitting stopper or plug secured with a cap or boot. The top is sealed in the same fashion after the bottom is secured. This ensures that the sediments will not be disturbed during transport since the core will not contain an air/water interface through which seiche currents (sloshing) can occur in the overlying water; such currents can suspend the surface sediments in the core.

Because the core is brought onboard the vessel prior to being sealed, some of the overlying water will be likely be lost. In this case, after the bottom of the core is secured, the core will be carefully "topped off" with site water before the top is sealed. The cores will be kept at or near *in situ* temperature, and carefully transported to the laboratory for leach testing and physical characterization. Every effort will be made to maintain the cores at 45 degrees to upright during transport.

6.4.3.3 Subtidal Surface Grab Sample Collection and Processing

Subtidal surface grabs will be collected during Sampling Events 1A and 1C.

Collection -

Sediment samples will be collected in a consistent, repeatable manner with a stainless steel modified 0.1-m^2 double van Veen grab sampler. To be consistent with the Commencement Bay RI, sampling for benthic infauna will be done using a stainless steel, modified 0.06-m^2 van Veen grab sampler. The sampling procedures for both samplers are identical. The sampling device will be attached to the winch cable with a ball bearing swivel to prevent twisting movements during deployment. The device will be raised and lowered through the water column by the vessel's winch at a rate no greater than 20 meters per minute. This will ensure that the sampler doesn't flip over on descent and will prevent disturbance of the sediment surface on retrieval. Once the sampler is brought onboard, it will be placed on the sieving stand. Access doors on the top of the sampler will allow visual characterization of the sediment surface in order to assess sample acceptability. Before characterization, the overlying water in the sampler will be removed by siphoning.

Samples must meet the following acceptability criteria, which are consistent with PSEP guidance (PSEP 1986b):

- Sediment is not to extrude from the upper surface of the sampler.
- No water leakage from the sampler is allowed.
- The sediment surface must be relatively flat.
- For biological and chemical replicates, the difference in penetration depth between replicates within a station can be no more than 10 percent. If the criteria are not met, sampling will continue until they are met. The following are minimum penetration depths.

Medium-coarse sand	4-5 centimeters
Fine sand	6-7 centimeters
Silt/clay	10 centimeters

At stations where less than 10 cm is recovered due to compacted sediments, the actual penetration depth will be recorded.

Prior to removal of sediment for chemical and toxicity analyses, certain parameters and qualitative environmental observations will be recorded. The following physical characteristics of the sediment in each of the surface sediment grab samples will be described and recorded on field logs: sediment texture; sediment color; presence, type, and strength of odors; grab penetration depth (nearest 0.5 centimeters); degree of leakage or sediment surface disturbance; and any obvious abnormalities such as wood/shell fragments or large animals.

Processing for Conventionals, Chemicals of Concern, Toxicity Test Sediments -

Since an undisturbed sediment surface is necessary for chemical sampling, the physical characterization of the sediment in the grab sample will be delayed until after the chemical samples have been taken. Sediment for physical (i.e., grain size), chemical and toxicity analyses will be taken from the surface 10 centimeters using a stainless steel sampling device that is designed to penetrate 10 cm into the sediment. The stainless steel sampling device is gently pushed 10 centimeters into the sediment and carefully removed from the sampler so that the sediment sample remains inside of the sampling device. Sediment that is in contact with the sides of the sampler will not be removed for laboratory analysis. Large organisms and pieces of debris will be removed, their removal will be noted in the sample log sheet, and the sample will be placed into a stainless steel mixing bowl for homogenization. Sediment from the surface 10 centimeters of several grab samples will be composited and homogenized prior to being placed in containers for analysis. The container sizes needed to ensure that enough sediment is provided for analysis and reanalysis are provided in Table 9.

Because the compositing and homogenizing process may release sulfides and volatile organic compounds, the sediment for these analyses will be taken from the upper 10 centimeters of one randomly selected grab sample prior to removal of other sediments for homogenization.

At approximately 5 percent of the stations, rinsate blanks will be prepared during compositing and submitted to the laboratory for analysis.

Samples collected in the field for toxicity testing will be composited and placed into 2-liter borosilicate glass jars with teflon-lined lids. Care will be taken to ensure that no headspace remains in the top of the jar. However, where there is insufficient volume to fill a jar, or if sediment settling has occurred, those jars will be overlaid with nitrogen gas.

Sediment samples for grain size will be kept in a cool place; samples for organics, metals, TOC, sulfides, and bioassay analysis will be stored on ice prior to delivery to the laboratory for analysis.

Processing for Benthic Infauna -

When characterization of benthic grab samples is complete and recorded in the field logbook, the sampler will be opened and the sediment released into the top section of the sieving stand. The sampler will be carefully washed of sediment adhering to the inside and prepared for its next descent. The sediment will be broken up with a gentle spray of seawater and rinsed into the lower section of the sieving stand where the 1.0-millimeter mesh sieve screens are located. Once the sieving is complete, the remaining material will be rinsed into thick plastic bags or plastic jars for preservation.

The samples will be preserved with a formaldehyde solution buffered with sodium borate. The formaldehyde is further buffered with seawater to a concentration of 15 percent. Samples containing large volumes of fine-grained sand or wood fragments will require a higher concentration of formaldehyde. Caution will be exercised when handling formaldehyde mixtures due to its toxicity (Kitchens et al. 1976). The sample bags or jars will be labeled in indelible ink on water resistant paper. Both internal and external labels will be used. The sample containers will be inventoried and placed in labeled buckets or boxes for return to the laboratory. The samples will be entered on chain-of-custody forms at this time.

The sample collection checklist and the chain-of-custody log will be completed immediately following sample collection.

6.4.3.4 Intertidal Sample Collection and Processing

Intertidal sampling will occur during Sampling Event 1B and perhaps Sampling Event 1C, depending on the results of Event 1B. Samples collected during Event 1B will be analyzed for conventionals and chemicals of concern shown in Table 2 of EPA's SOW. At stations where chemical concentrations are between SQO and 2LAET based on Event 1B, additional samples may be collected during Sampling Event 1C for chemical and biological testing. Alternatively, the HCC may elect, with EPA's approval, to not complete biological analyses and accept the SQO exceedance found during Event 1B.

A preliminary visual survey of the intertidal areas along Hylebos Waterway was conducted during the week of March 28 - April 1, 1994 when tides were below elevation -1 foot MLLW. The survey utilized a small boat to examine the shoreline and look for potential sources of contamination. The survey provided information for selection of sampling areas for Event 1B. The locations of the sampling areas will be reported in the SAP Addendum for Sampling Event 1B.

Sampling areas will be selected using the following information:

- The presence of anthropogenic material which may be a source of chemicals of concern
- The presence of outfalls, storm drains, pipes, or seeps
- The presence of sediments capable of being collected using a hand-held sampling device
- Spatial distributions of chemical or biological constituents that indicate the presence of a potential source.

Station locations will be provided in the SAP addenda for Sampling Events 1B and 1C. It is expected that sampling for Event 1B will occur in July 1994. Collection of intertidal samples is expected to last approximately 10 days.

Logistics -

During Sampling Events 1B and 1C, sampling will be conducted by field crews operating from small boats. The field crews will be supported by a sample processing station located either on shore or on the R/V Kittiwake. The sample processing station will be used to decontaminate sample collection and handling equipment, homogenize and distribute sample material to collection jars, and sieve and preserve benthic samples. Two field crews will operate simultaneously to collect sediment samples and a third crew located at the sample processing station will process the samples and place them into the sample jars.

Collection of Sediment for Chemical and Toxicity Analyses -

Sample collection methods will be the same during Sampling Events 1B and 1C. Sampling and processing of intertidal core samples will be conducted according to accepted methods and protocols (Gonar and Kemp 1978; Zeh et al. 1981; Hart-Crowser et al. 1991). A stainless steel sampling device will be used to sample the upper 10 centimeters of sediment. A valve on top of the device will be opened to allow air and water to escape, thereby preventing compression of the sediment surface. The device will be gently pushed into the sediment to the 10 centimeter mark, using a twisting motion to facilitate penetration. Care will be taken to ensure that the sediment surface does not come into contact with the top of the sampler. The retention plate will then be placed into its slot to prevent the sediment from falling out of the corer, and the valve will be closed. The corer will then be slowly extracted from the sediment for processing. Prior to processing, the following acceptability criteria must be met:

- The coring device penetrated to the minimum acceptable penetration depth
- Minimal water is present within the sample core
- No loss of sample occurred prior to compositing.

After each sample is accepted, it will be described in the field log. Qualitative characteristics of the sample will be recorded on this form.

Sediment from multiple cores will be composited into stainless steel mixing bowls for chemical (Event 1B) or chemical and toxicity testing (Event 1C). A total volume of about 3 liters of sediment at each station will be required for chemical analyses (Event 1B) and a volume of about 9 liters will be required for chemical and toxicity analyses (Sampling Event 1C). Samples for volatile organics and sulfides will be collected and placed into sample containers while the field crew is onshore to reduce volatilization of the constituent compounds. The bowls will be covered with aluminum foil and transported to the sample processing station when they are full.

Collection of Sediment for Benthic Infauna -

If proposed by the HCC, the coring method for collection of benthic infauna during Sampling Event 1C will be similar to the method for sediment chemistry samples. Samples would be collected at each station and placed in individual plastic buckets. The buckets would be transported to the sample processing station for sieving.

If proposed by the HCC, specific information on the number of replicates, reference areas, and data evaluation process will be provided to EPA in the SAP addendum for Event 1C.

Processing for Conventionals, Chemicals of Concern, Toxicity Test Sediments -

Once all sediments from a station are at the sample processing station, the sample will be thoroughly homogenized and distributed to sample containers, using the same methods as described previously. Sample sizes and volumes for testing are identical to those for the subtidal surface sampling event (Table 9). At approximately 5 percent of the stations, rinsate blanks will be prepared during compositing and submitted to the laboratory for analysis. The field log sheet will be completed during sample processing.

All sample containers will be labeled on the outside in indelible ink with the sample identification number, date collected, and analysis to be performed.

Sediment samples for grain size will be kept in a cool place; samples for organics, metals, TOC, sulfides, and bioassay analysis will be stored on ice at approximately 4°C until returned to the laboratory for analysis.

Chain-of-custody procedures for the intertidal samples will follow those described for the subtidal portion of the program.

Processing for Benthic Infauna -

Intertidal benthic infauna samples will be transported to the sample processing station in individual plastic buckets. Once onboard, they will be processed in the same manner as described above for the subtidal benthic infauna samples.

6.5 CHAIN-OF-CUSTODY PROCEDURES

Since samples collected in support of CERCLA activities may be used in litigation, their possession must be traceable from the time of sample collection through laboratory and data analysis to introduction as evidence. To ensure samples are traceable, the following procedures will be followed.

6.5.1 Sample Transfer

The cruise leader, as the designated field sample custodian, will be responsible for all sample tracking and chain-of-custody procedures for samples in the field. The sample custodian will be responsible for final sample inventory and will maintain sample custody documentation. The custodian will complete chain-of-custody forms prior to removing samples from the sampling vessel. An example of a suitable chain-of-custody form is provided in Figure 12. This form will be used for samples that are en route from the vessel or core processing laboratory to the testing laboratories. For cores that are enroute to the core processing laboratory, a chain-of-custody form is incorporated into the field log for the core samples (Figure 10). Upon transferring samples to the laboratory sample custodian, the cruise leader will sign, date, and note the time of transfer on the chain-of-custody form.

Each laboratory will also designate a sample custodian, who will be responsible for receiving samples and documenting their progress through the laboratory analytical process. Each custodian will ensure that the chain-of-custody and sample tracking forms are properly completed, signed, and initialed on transfer of the samples.

6.5.2 Chain-of-Custody Seals

Samples will be shipped to the laboratory in ice chests sealed with custody seals. Each ice chest will have three seals—one on the front of the chest and one on each side. The integrity of the seals will be established at the laboratory by the laboratory sample custodian.

6.5.3 Laboratory Custody Procedures

Upon receipt of the samples at the laboratory, the laboratory sample custodian will inventory the samples by comparing sample labels to those on the chain-of-custody document. The custodian will enter the sample number into a laboratory tracking system by project code and sample designation. The custodian will assign a unique laboratory number to each sample and will be responsible for distributing the samples to the appropriate analyst or for storing samples in an appropriate secure area. Specific laboratory chain-of-custody procedures are described in the laboratory QA Plans for each of the designated labs (Appendix B).

6.6 SAMPLE HANDLING AND TRANSPORT PROCEDURES

On completion of final inventory by the field sample custodian, each glass sample container will be placed into a "bubble wrap" plastic bag. Samples will then be placed into an ice chest lined with a large plastic bag. When the ice chest is full, the chain-of-custody and the sample analysis request form will be placed into a zip-locked bag and taped onto the inside lid of the ice chest. Each ice chest will be sealed with chain-of-custody seals and transported to the laboratory by car courier. Samples slated for delivery to toxicity testing laboratories will be placed in separate ice chests and delivered to the appropriate laboratory. These packaging and shipping procedures are in accordance with U.S. Department of Transportation regulations as specified in 49 CFR 173.6 and 49 CFR 173.24.

The coolers will be clearly labeled with sufficient information (name of project, time and date container was sealed, person sealing the cooler, and SEA's office name and address) to enable positive identification.

6.7 QUALITY CONTROL PROCEDURES FOR FIELD SAMPLING

6.7.1 Performance Audits

Field performance audits will be conducted at least once during each field program by the field QA manager. The audits will involve assessing the sample collection and processing procedures relative to the procedures described in the Puget Sound Protocols (PSEP 1986a, 1987, 1989a,b) and relative to standard procedures for collection of subtidal cores. Data recording procedures will be reviewed for completeness.

6.7.2 Corrective Actions

Results of the field performance audit may identify the need for corrective actions. The field QA manager will institute the necessary corrective actions immediately and will conduct an additional audit to ensure that the correct procedures continue to be followed.

6.8 SPECIFIC INFORMATION FOR SAMPLING EVENT 1A

Sampling Event 1A includes collection of subtidal subsurface cores to determine the depth distribution of chemicals of concern, and collection of subtidal surface grabs to assess the spatial distribution of chemicals of concern in surface sediments. For the coring program, the chemical and data analyses will be consistent with the EPA CLP and PSDDA program methodologies, and sampling and compositing will be done according to PSDDA methodologies. Surface sediments will be collected using PSEP protocols (PSEP 1987) and analyzed in accordance with the EPA CLP and PSDDA program methods described in Chapter 7.

6.8.1 Selection of Sampling Locations

The selection of sampling locations was based on the mechanisms of sediment contamination described in Section 6.1.1, the locations of past and present industries that may release chemicals to the waterway, and the distributions of sediment chemicals reported in the RI and FS. A total of 58 core stations distributed among five segments were selected for sampling during Event 1A (Table 10). Station locations are shown in Figure13a-c, and the position coordinates are provided in Table 11.

The waterway was divided into the five segments identified in the RI/FS, and the number of stations in each segment reflects the areas of concern discussed in the FS. The distribution of stations in the segments are as follows: In segment 5 there are 17 stations (note that two of these stations are located near the mouth of the waterway in an area of low concern); segment 4 contains 12 stations; segment 3 has 6 stations; segment 2 has 11 stations; and segment 1 contains 13 stations. Segment 3 contains few stations due to its low ranking as an area of concern in the FS. As discussed in the FS, Segment 4 was not ranked especially high in the area of concern list because the chemical distributions were not wide-spread. However, there were unexplained hot spots in the segment and these were of sufficient concern that a portion of Segment 4 was combined with segment 5 to create the mouth of Hylebos problem area which is discussed in detail in the FS. For that reason more stations were placed in Segment 4 than in Segment 2 where the distribution of chemicals was well documented.

6.8.2 Identification of Samples for Analysis

The general compositing strategy for the sediment cores was discussed in Section 6.4.3.1. Based on that approach, the samples are shown in Table 12, which identifies the sampling stations, sampling depths, and core sections. All of the recent sediment samples (67 samples) will be submitted for analysis, along with native sediments from roughly half of the stations (29 samples). Native samples were selected based on the following objectives: 1) provide general geographic coverage of the native sediment throughout the waterway; 2) provide general coverage of the different native sediment types encountered in the waterway; and 3) provide coverage of native sediment in areas of possible contaminated groundwater.

In addition to the core samples, one field sample from surface sediments at each location will be collected and analyzed.

Analysis of tributyltin (TBT) will occur at the 16 stations identified in Table 13. Stations located adjacent to past or existing marinas, boat repair and boat construction facilities were selected for analysis of TBT. At these stations, surface grab samples and the surface core section will be analyzed. In the event that data gaps which would influence the delineation of sediment management areas are evident in the TBT data, additional analyses may be conducted using archived sediment.

QC samples that represent subsurface cores and surface sediments will be collected at approximately 5 percent of the stations. These samples include blind field replicates, blind field splits, and rinsate blanks. The estimated number of field and QC samples for Sampling Event 1A is shown in Table 14.

6.8.3 Sampling Schedule

Sampling is expected to begin 10-20 days after EPA approves this SAP/QAPP, pending the availability of the sampling vessel and equipment, and pending gaining property access from property owners. Sampling will take 2-3 weeks to complete. It is anticipated that surface grab sampling will begin prior to subsurface coring and may end after coring has been initiated. The order in which stations will be occupied for surface grab sampling and subsurface coring will depend to some extent on vessel traffic patterns at the industries located along the waterway, as well as on the movement patterns of log booms. Where proposed sampling locations may be inaccessible due to the presence of barges, log rafts, log booms, or other obstructions, the owners/operators will be contacted prior to the initiation of field activities to facilitate relocation or removal.

7.0 LABORATORY ANALYSIS AND QUALITY CONTROL

Sampling and analysis supporting pre-remedial design is required to be sufficient to satisfy the data quality objectives identified in the SOW (EPA 1993). In accordance with the requirements of this project, the analytical plan and associated quality assurance and quality control (QA/QC) procedures were developed with consideration of the analytical protocols in the EPA Contract Laboratory Program (EPA 1992) and the Puget Sound Estuary Program guidance (EPA 1989a,b). PSDDA guidance (PSDDA 1989) is also satisfied by these requirements.

The following sections describe the laboratory analysis and QA procedures for analytical chemistry, contaminant mobility, sediment toxicity, and benthic infauna.

7.1 ANALYTICAL CHEMISTRY PROCEDURES

Chemical analyses of sediment and leach test water are required under the SOW (EPA 1993). If other matrices are required in the future, the associated methods and QA procedures will be presented in the appropriate SAP addendum. Laboratory quality assurance will be implemented and maintained as described in this plan and according to each of the identified laboratories' respective QA programs, plans, and standard operating procedures (SOPs) (Appendix B).

For sediments, the analytical methods and QC measurements and criteria are based on current CLP and SW-846 requirements, PSEP guidance, and PSDDA requirements. Laboratory deliverables are consistent with the requirements of PSDDA QA2. Some of the analytical methods cited below for water are fundamentally CLP IFB/SOW methods, but have been revised to meet DQOs for this project. The modifications are consistent with the PSEP guidelines and achieve PSDDA requirements.

Target analytes, required quantitation limits, and reference analytical methods are listed in Table 6 for sediments and Table 7 for water. For comparison, two different types of quantitation limits are provided for each sediment analyte: CLP contract required quantitation limits (CLP CRQL) and project required quantitation limits (PRQL). The PRQL are based on the Chemical Decision Criteria for sediments specified in Table 7 of the SOW. The quantitation limits for water analyses are low enough to support the contaminant mobility studies. These low detection limits can also be expected to minimize reporting of nondetected values above more typical or routine quantitation limits. While a best effort will be made to achieve the project DQOs and goals specified, there will be cases in which a best faith effort may not meet the specified goals. Any limitation in data quality due to analytical problems (e.g., due to highly contaminated samples) will be clearly identified.

Modifications to established analytical methods will be necessary to achieve project DQOs. In some cases, the sample size and final volume of the digestate or extract may be adjusted to achieve required minimum quantitation levels. For example, for analysis by ICP of cadmium, arsenic, and silver in sediments, it may be necessary to reduce the final digestate volume from 200 milliliters (per CLP methods) to 100 milliliters. This modification is a SOP in many environmental analytical laboratories to improve detection limits and low-level precision.

Soil Technology, Inc. of Bainbridge, Washington, will perform selected tests for sediment physical characterization. These tests include Atterberg limits, specific gravity, gravimetric water content, and selected sample grain size analyses. Columbia Analytical Services of Kelso, Washington, will perform metals analyses in sediments and water, as well as sediment grain size and total volatile solids analyses. Analytical Resources, Inc. of Seattle, Washington, will perform the following analyses: acid, base, and neutral organic compounds in sediments and water, pesticides and PCBs in sediments and water, and volatile organic compounds, tributyltin, total organic carbon, ammonia, pH, and total sulfides analyses in sediment.

Functional statements for those analytical methods requiring some modification of standard [or otherwise referenced/documented] procedures necessary to achieve project DQO's are provided in Sections 7.1.1 and 7.1.2. Detailed and complete standard operating procedures (SOPs), laboratory QA program plans, laboratory safety plans, and example deliverables for each laboratory are provided in Appendix B.

7.1.1 Analysis of Water Samples

7.1.1.1 Metals

Metals will be analyzed under clean laboratory conditions by a method that requires pre-concentration via reduction and precipitation before instrumental analysis by EPA method 200.8. Mercury will be analyzed by SW-846 Method 7470, cold vapor atomic absorption spectrophotometry (CVAA). Analyses will be accompanied by the QC reporting requirements in the CLP statement of work. For sample sizes $\geq$500 milliliters, pre-concentration of analytes other than mercury, combined with the removal of the salt matrix (and chloride interference) is accomplished by a procedure described by Sturgeon et al. (1988) and Christian (1993). In this procedure, palladium and iron are added to samples to act as carriers for reduced metals and precipitated borides. Reduction of metals is accomplished with the addition of $NaBH_4$. Subsequent instrumental analysis is accomplished via EPA method 200.8. For water sample sizes <500 milliliters, analyses will be accomplished by dilution and direct injection to ICP/MS (EPA method 200.8), thus raising the detection limits.

7.1.1.2 Extractable Organic Compounds

In water derived from contaminant mobility tests, extractable organic compounds (including acids/neutrals and PCBs) will be analyzed by gas chromatography/mass spectroscopy - selective ion monitoring (SIM) (GC/MS-SIMs) and gas chromatography/electron capture detection (GC/ECD). A 300-milliliter sample is spiked with surrogate compounds and subsequently acidified with concentrated HCl to pH 2. The acidified sample is extracted three times with 60-milliliter aliquots of $MeCl_2$. The combined extracts are dried over anhydrous Na_2SO_4 and concentrated to 10 milliliters utilizing Kuderna-Danish apparatus. Nine milliliters of the concentrated extract is reduced to a final volume of approximately 0.5 milliliters using N_2 blowdown. Internal standards are added to the aliquot and analyzed for acid and neutral analytes by GC/MS-SIMs. Instrumental setup requires consideration of the instrumental parameters identified in the CLP SOW, with exceptions/modifications where required for mass spectrometry operation utilizing SIMs. Multiple ions (generally three) are required for identification of each target parameter as well as quantitation utilizing the preferred ion, typically the base peak identified in a full-scan acquisition. PCBs are analyzed by taking the 1-milliliter aliquot (the 1-milliliter aliquot remaining from the 10-milliliter split) through an alumina column cleanup to remove interferents. The cleaned extract is then concentrated to approximately 0.5 milliliters and analyzed for PCBs by GC/ECD (with internal standard calibration and quantitation). Instrumental setup is similar to that described in the CLP statement of work. Reporting requirements for QC data and sample results are consistent with the reporting requirements identified as PSDDA QA2 deliverables. The following information will be generated and reported:

- Instrument performance checks
- Initial calibrations
- Continuing calibrations
- Blanks
- Surrogate spikes
- Matrix spikes/matrix spike duplicates (utilizing all target analytes)
- Internal standards

- Compound identifications by characteristic ion ratios and RRT
- Quantitation using quantitation ions from CLP SOW (for GC/MS)
- Selected ion chromatograms for all ions used [for samples and calibrations].

7.1.2 Analysis of Sediment Samples

7.1.2.1 Atterberg Limits

As part of sediment characterization for dredging and engineering properties, Atterberg limits will be determined on selected fine-grained sediments in accordance with *American Society of Testing and Materials* (ASTM) method D-4318. The results of the Atterberg limits analysis and plasticity characteristics will be used in conjunction with the results from the grain size analysis to determine the Unified Soil Classification (USC) and to describe the sediments for engineering purposes in accordance with ASTM D-2487. Units will be reportable to limits of 1 percent.

7.1.2.2 Specific Gravity

Specific gravity will be measured on samples analyzed for dredging and contaminant mobility properties in accordance with ASTM D-854 and will be reported as specific gravity values.

7.1.2.3 Gravimetric Water Content

Gravimetric water content will be determined in accordance with ASTM D-2216 on project samples selected for engineering properties including those collected for contaminant mobility studies. Water contents will be reported as percent water (dry-weight basis) to limits of 1 percent. Percent solids (wet-weight basis) will also be determined and reported for all sediment samples received by each laboratory for reporting of dry-weight normalized sample results.

7.1.2.4 Grain Size

Grain size analysis will be accomplished on all project samples according to PSDDA guidelines using either ASTM D-422-63 (Wet Sieve with Hydrometer) or the PSEP protocols and guidelines (PSEP 1986b). Eight class fractions will be determined. Peroxide oxidation will not be employed so that biological aggregates are not broken apart. Results will be expressed by class percentage (reportable to 0.01 percent) in the following fractions: gravel (-6--1 ø), v. coarse sand (-1-0 ø), coarse sand (0-1 ø), medium sand (1-2 ø), fine sand (2-3 ø),

v. fine sand (3-4 ø), sand(-1-4 ø), silt (4-8 ø), clay (>8 ø), and fines (>4 ø). Results will be presented in tabular format and, in addition for selected samples, plotted on semilogarithmic paper as percent fines by weight versus grain size.

7.1.2.5 Total Organic Carbon

Total organic carbon content will be measured according to guidelines found in the PSEP protocols (PSEP 1986b) and options recommended in Michelsen, 1992. Sample pretreatment with HCl is required to liberate inorganic carbon (principally carbonates). TOC analysis will be performed by oxidizing the sample at ~850°C and then measuring CO_2 via infrared spectrophotometry. Results are expressed in terms of carbon per dry weight of the unacidified sample.

7.1.2.6 Total Sulfides

Total sulfides will be measured according to the PSEP protocols (PSEP 1986b). This parameter includes acid-soluble H_2S, HS^-, and $S^=$. Acid-labile sulfide is distilled and measured spectrophotometrically by a methylene blue method.

7.1.2.7 Metals

Metals will be determined according to the methodology found in the CLP IFB/SOW (current version ILM03.0). Sample digestion is accomplished with HNO_3/H_2O_2, and final digestate volumes may be reduced to 100 milliliters to improve sensitivities. The method of standard additions (MSA) may be required to improve precision when digestate salt content results in instrumental interferences.

7.1.2.8 Acid, Base, and Neutral Extractable Organic Compounds

Acid, base, and neutral (ABN) extractable organic compounds in sediments will be analyzed by the methodology found in the CLP IFB/SOW or SW-846 methods 3550/8270, with some modifications recommended in the PSEP guidelines in order to meet project DQOs. Procedural modifications include the following:

- Include additional surrogate compounds with the CLP-specified surrogates (additional compounds include d_4-1,2-dichlorobenzene, d_4-2,3,5,6-*p*-cresol, d_{10}-anthracene, d_{10}-fluoranthene, and d_{14}-dibenzo(a,h)anthracene).

- Extract 100- to 150-gram (wet wt) samples via sonication/homogenization followed by gravity settling and separation.

- Dry primary extract over anhydrous Na_2SO_4.
- Use gel permeation chromatography (GPC) for cleanup and for removal of elemental sulfur (S_x).
- Adjust final extract volumes to give sufficient sensitivity and instrumental response without overloading.
- Establish GC/MS initial calibration with six to seven calibration points in the range of 2-100 ng/μl for all target analytes.
- Conduct continuing calibration for all target analytes and surrogate compounds.
- Perform matrix spike and matrix spike duplicate analyses for all of the target analytes.
- Analyze chlorinated benzenes (up through trichloro-) and hexachlorobutadiene by SW-846 method 8260 (GC/MS purge and trap for VOAs). Instrumental operating parameters will be modified and calibration curves will be determined to include these analytes during VOAs analyses. This modification will allow lower detection limits than by the ABNs' GC/MS method, which tends to suffer from low recoveries for compounds with these vapor pressures. Hexachlorobenzene will also be a target analyte during the GC/ECD analyses utilizing method 8080 for improvement in sensitivity.

Both matrix spike and surrogate spike compounds will be added prior to sample extraction, as required by the analytical method.

It is anticipated that PRQLs for all analytes in a sample may not be attained due to chemical interferences, especially in those samples exhibiting elevated levels of other target analytes (at levels much greater than their respective PRQLs). Some prescreening of samples may be accomplished using CLP prescreening methodology to determine sample size requirements for full analysis.

7.1.2.9 Chlorinated Pesticides and PCBs

Chlorinated pesticides and PCBs will be analyzed by methodology specified in the most recent CLP IFB/SOW or SW-846 methods 3550/8080, with the following procedural enhancements:

- Add an additional surrogate compound, dibromooctafluorobiphenyl, along with the CLP-specified surrogates.

- Extract approximately 50 grams of sample via sonication/homogenization.

- Remove elemental sulfur (S_x) from the sample extract during GPC cleanup. Additional S_x removal may be required using chemical agents, at the discretion of the analyst.

- Conduct alumina column chromatography of extracts (required and not discretionary).

- Adjust final extract volumes to achieve analyte PRQLs and to prevent instrumental overloading.

- Adjust instrumental operating parameters to permit the simultaneous analysis of chlorinated benzenes and hexachlorobutadiene at levels less than GC/MS detection/quantitation limits.

All associated QC will be as required for the CLP. Data deliverables will be as required for PSDDA QA2 data reporting requirements. Deliverable requirements are described in Section 7.1.5.

7.1.2.10 Volatile Organic Compounds

Volatile organic compounds will be analyzed in sediments using purge and trap GC/MS technique. The analytical method will be as described in the CLP SOW or by SW-846 method 8260. All quality control criteria will be identical to that of the CLP SOW. Deliverables will be consistent with the PSDDA QA2 data requirements.

7.1.2.11 Tributyltin

Sediment samples adjacent to marinas or properties with boat yards (Table 13) will be analyzed for tributyltin using SW-846 methods 3510/8270, modified according to Krone (1989). The modifications include use of Grignard reagent for derivatization followed by GC/MS-SIMs. Quantitation limits are in the range of 10 - 25 ug/kg. The analytical SOP is found in Appendix B. Deliverables will be consistent with PSDDA QA2 data requirements.

7.1.3 Quality Control Requirements and Internal Quality Control Checks

Quality control procedures for laboratory analysis will be consistent with the requirements described in each laboratory's protocols and methods. These requirements are also presented in SOPs as part of the laboratory's QA program plan (see attached lab QA program plans in Appendix B). Methods for establishing the quality of laboratory measurements and sample results will generally conform with CLP quality control requirements and quality criteria (when present). Additional QC measurements will be made and reported for purposes of evaluating data quality specific to this project. Some modifications have been made to a) expand the range of instrumental calibrations, b) reduce quantitation limits, and c) establish precision at quantitation levels below those of CLP. These changes are necessary to meet the chemical evaluation criteria for this project. Data validation and reporting of data quality will conform with the criteria of the EPA data validation functional guidelines for metals and organics (EPA 1988a,b). All QC measurements and data assessment for this project will be conducted on samples from and within batches of samples from this project alone; samples from other projects will not be mixed with samples from this project for assessment of data quality. PSEP guidelines will be used for evaluating and establishing data quality where analytes/parameters are not addressed by the EPA CLP.

7.1.3.1 Sample Handling and Storage

Procedures for laboratory sample handling and storage are documented in a written SOP for each of the laboratories. Table 9 summarizes requirements for sample containers, preservation, and holding times.

7.1.3.2 Instrument Calibration and Checks

Instrument calibration and checks will conform with analytical protocol requirements and laboratory analytical SOPs, which are found in the laboratories' QA plans (Appendix B).

7.1.3.3 Methods for Assessing Precision

Precision will be assessed by examining analytical and field variability, using three types of measurements: sample splits, blind sample replicates, and blind station replicates.

Sample Splits -

Sample analytical variability, determined by the analysis of laboratory generated sample splits for sediments and water at a frequency of 5% or once per batch of 20 samples from this project, will be used for determination of relative percent differences (RPDs). Variabilities in organic compound analyses will be evaluated by analysis of matrix spike and matrix spike duplicate samples. Samples for inorganic analyses will be split in the laboratory and separately analyzed at native levels. Conventional parameters will be analyzed in triplicate, rather than in duplicate as with organics and metals. Quality control objectives and limits for analysis of laboratory splits are consistent with CLP requirements and are summarized in Table 15 for sediments and Table 16 for leach waters.

Blind Field Samples-

Verification of laboratory measurements of sample analytical variability will be accomplished for sediments by analyzing blind field samples that are generated in the field by subsampling the composited sample. These samples will help determine if other sources of variability outside of laboratory sample handling and manipulation are present or unaccounted for. Blind field samples will be generated at approximately 5 percent of the stations.

Blind Field Replicates -

An assessment of variability associated with combined analytical and environmental variabilities will be accomplished by analysis of blind field replicates. Station replicates represent separate sediment samples collected and composited independent of the primary sample and associated sample splits. [Samples will be specifically identified to the laboratory for use in generation of *laboratory splits* (also split for MS/MSD analysis for organic compounds). The same station will also be used for generation of blind field samples and blind field replicates. All field generated splits/replicates for assessment of analytical and field variabilities are submitted blind to the laboratory.] Each of these replicates will be generated at approximately 5 percent of the stations. This scheme for assessing both analytical and monitoring variabilities has proved useful in the PSAMP and some PSDDA programs. These results will be taken into consideration during assessment of the overall uncertainty and significance of the data used in site characterization and pre-remedial design.

Method, Holding, and Field Blanks -

Introduction of contaminants during sampling and analytical activities will be assessed by the analysis of blanks. Laboratory method blanks, generated in the laboratory, will be analyzed at a minimum frequency of 5 percent or one per analytical batch of 20 for all chemical parameter groups. An additional "holding" blank will be generated and analyzed for volatile organic compound analyses (VOAs) only. Holding blanks will be generated and associated with each batch of VOA samples received and analyzed by the laboratory. These blanks will be used to determine if volatile chemicals are introduced to samples during holding or storage prior to analysis. Field blanks, consisting of sampling equipment rinsates, will be generated for all chemical parameter groups at approximately 5 percent of the stations, and submitted for analysis to the laboratory. For VOA's, field blanks will consist of trip or transport blanks to assess potential for introduction of contaminants during sample transport and holding.

7.1.3.4 Methods for Assessing Accuracy

Accuracy will be assessed in terms of analytical recovery for all chemical analytes. Independent reference materials, when available, will also be used to assess accuracy. Analyte recovery will be measured at a minimum frequency of 5 percent or one per batch of up to 20 samples. Recoveries of organic compounds will be assessed by spiking all organic compounds during MS/MSD analyses of project samples. Inorganic recoveries will be assessed as required by the CLP for matrix spikes (no MSDs) at a minimum frequency of 5 percent or one per batch of up to 20 project samples. Data will be qualified during data validation, dependent upon matrix spike recoveries. QC objectives and criteria are summarized in Tables 15 (sediments) and 16 (water).

Surrogate compound analysis for organics will also be employed to evaluate recovery. CLP requires qualification of organic compound results when surrogate recoveries fall outside acceptance limits. CLP criteria and requirements, summarized in Table 15 for sediments, will be employed for the analyses conducted in this program and will be used to support the evaluation of laboratory results during data validation. Additional surrogate compounds, identified above, will be spiked along with the CLP-specified surrogates during the analysis of extractable organic compounds. While these additional surrogates will provide supplementary information for evaluating method performance and for troubleshooting, their use for qualifying data during data validation activities is currently not being considered. Table 16 presents the QC criteria for evaluating surrogate recoveries during low-level leach water analyses.

7.1.3.5 Analytical Instrument Testing, Inspection, Maintenance, Setup, and Calibration

Analytical instrument testing, inspection, maintenance, setup, and calibration will be conducted in accordance with the QC requirements identified in each laboratory's SOPs, attached with the laboratory QAPP (Appendix B). In addition, each of the specified analytical methods provides protocols for proper instrument calibration, setup, and critical operating parameters.

7.1.4 Laboratory Sample Custody Procedures

Upon receipt by each laboratory, each sample will be checked for physical integrity and logged into a Laboratory Information Management System. Samples will be handled and stored so as to maintain sample integrity before and after analysis. Specific SOPs for sample handling, tracking, storage and custody are found in each laboratory's QAPP (Appendix B).

7.1.5 Laboratory Data Deliverables

Laboratory results and data deliverables will consist of hardcopy documentation of the laboratory procedures used and will be consistent with PSDDA QA2 data requirements. For non-CLP analytes, documentation will be prepared according to the deliverables described in the laboratory QAPP and SOPs. All documentation will be sufficient to allow a CLP-type review during data validation. This information shall be sufficient to review the data with respect to the following:

- Holding times and conditions
- Instrument calibration
- Detection/quantitation limits
- Surrogate recoveries
- Replicate analyses (duplicates and MS/MSDs)
- Precision and accuracy
- Completeness
- Data report formats.

Electronically formatted data (diskette) deliverables will be required to expedite data review and validation.

7.1.6 Data Reduction, Validation, and Reporting

Initial data reduction, evaluation, and reporting performed at the laboratory will generally be in conformance with the CLP statements of work for organic and inorganic analyses, or be based on the laboratory SOPs when CLP procedures are not available or specified. Specific deliverables will be as required for reporting of PSDDA QA2 data.

The laboratory will assign data flags, or qualifiers, following CLP protocols for organic and inorganic analyses. The laboratories are required to immediately notify the Project Chemist when any QC measurements are consistently outside of project QC criteria or DQOs. The problem will be reviewed to determine the causes and to effect a remedy. Use of additional surrogate and matrix spike compounds during organic compound analysis will be useful as tools to assist in the identification and characterization of analytical problems when they arise. This process will be documented to allow a determination of data quality and its possible limitations for project use.

Laboratory data reporting formats will be consistent with PSDDA QA2 data requirements which will allow a CLP-type data validation for all data generated. Electronically formatted data deliverables will be generated and delivered to the analytical chemistry QA manager. Complete manual data validation will be performed on 100 percent of the data by designated qualified data validators under supervision of the analytical chemistry QA manager. Data validation and reporting will be accomplished for all analytical parameters including conventional analytes and geotechnical parameters. Hardcopy data deliverables and documentation will be archived for all laboratory results and procedures, and will be made available to EPA upon request. QA2 data packages will be made available to the PSDDA agencies upon request.

The organics data will be evaluated in general accordance with EPA's *Laboratory Data Validation Functional Guidelines for Evaluating Organics Analysis* (EPA 1988b). CLP inorganics data will be validated in general accordance with EPA's *Laboratory Data Validation Functional Guidelines for Evaluating Inorganics Analysis* (EPA 1988c). Chemical data from non-CLP procedures will be reviewed with regard to the following, as appropriate to the particular analysis:

- Holding times and conditions
- Conformance with required analytical protocol(s)
- Instrument calibration
- Blanks
- Detection/quantitation limits
- Recoveries of surrogates and/or matrix spikes (MS/MSDs)
- Variability for duplicate analyses
- Completeness
- Data report formats.

In addition to the general reporting requirements identified above, PSDDA QA2 data delivery requirements for chemical variables are found below. Information found on the Corps of

Engineers' DAIS checklist will be provided to the Corps' Dredged Material Management Office.

7.1.6.1 PSDDA QA2 Data Deliverables for Organic Compounds

- A cover letter referencing the procedure used and discussing any analytical problems, deviations and modifications; including signature from authority representative certifying to the quality and authenticity of data as reported

- Report of sample collection, extraction and analysis dates, including sample holding conditions

- Reconstructed ion chromatograms for GC/MS analyses for each sample and standard calibration

- Selected ion chromatograms and mass spectra of detected target analytes (GC/MS) for each sample and calibration with associated library/reference spectra

- GC/ECD and/or GC/FID chromatograms for each sample and standard calibration

- Raw data quantification reports for each sample and calibrations, including areas and retention times for analytes, surrogates and internal standards

- A calibration data summary reporting calibration range used and a measure of linearity [include DFTPP and BFB spectra and compliance with tuning criteria for GC/MS]

- Final extract volumes (and dilutions required), sample size, wet-to-dry weight ratios, and instrument practical detection/quantitation limit for each analyte

- Analyte concentrations with reporting units identified, including data qualification in conformance with the CLP SOW (include definition of data descriptor codes)

- Quantification of analytes in all blank analyses, as well as identification of method blank associated with each sample

- Recovery assessments and a replicate sample summary [includes all surrogate spike recovery data with spike levels/concentrations for each sample and all MS/MSD results (recoveries and spike amounts)]

- Report of tentatively identified compounds with comparison of mass spectra to library/reference spectra

7.1.6.2 PSDDA QA2 Data Deliverables for Metals

- A cover letter referencing the procedure used and discussing any analytical problems, deviations and modifications; including signature from authority representative certifying to the quality and authenticity of data as reported

- Report of sample collection, digestion and analysis dates, with sample holding conditions

- Tabulated results for samples in units as specified; including data qualification in conformance with the CLP SOW, including definition of data descriptor codes

- Results of all method QA/QC checks including ICP Interference Check Sample and ICP serial dilution results

- Tabulation of instrument and method practical detection/quantitation limits

- Raw data quantification report for each sample

- A calibration data summary reporting calibration range used and a measure of linearity, where appropriate

- Final digestate volumes (and dilutions required), sample size, and wet-to-dry weight ratios

- Quantification of analytes in all blank analyses, as well as identification of method blank associated with each sample

- Recovery assessments and a replicate sample summary [includes post-digestate spike analysis, all MSA data (including spike concentrations) for each sample, if accomplished, all MS results (recoveries and spike amounts) and laboratory control sample analytical results].

7.1.7 Performance and System Audits

The Project Chemist will oversee the activities of all analytical chemistry support employed in this project. This oversight will be achieved through on-site inspections and reviews of analytical facilities prior to and during analyses of project samples.

Prior to initiating laboratory analyses, a QA evaluation and evidentiary audit of the laboratories will be performed in a manner similar to those procedures used for a CLP-type systems audit. CLP guidance and the laboratory QAPP and SOPs will be used as references for performing on-site laboratory evaluations. Continuing performance audits will be conducted on a regular basis to ensure data of known and sufficient quality are being provided by the laboratories. Independent commercial analytical reference materials (where available for the analytes of concern) will be used, at a minimum, at the beginning and end of each task or phase of the project as an independent assessment of the analytical process. The frequency of on-site audits depend on the type of interaction and communications the Project Chemist experiences with the laboratory staff, and on the frequency of observations of noncompliance with QC criteria and SOPs. The Project Chemist's interaction with the laboratories will be focused on coordination, management, and assessment of performance, and on the rapid institution of corrective actions, if required.

7.1.8 Preventive Maintenance

Preventive maintenance in the laboratory will be the responsibility of the laboratory personnel and analysts. This maintenance includes routine care and cleaning of instruments, and inspection and monitoring of carrier gases, reagents, solvents, reference materials, and glassware used in analyses. All maintenance of instruments and procedures is documented in maintenance log/record books. Each of the laboratories has SOPs for preventive maintenance (Appendix B).

7.1.9 Assessment of Data Quality

Data assessment will be based on criteria developed to address project DQOs. Laboratory performance and data assessment will consist of on-site audits and data evaluation during data validation activities as described above. Laboratory data will be qualified with the use of data descriptors assigned by the laboratory and during independent data validation.

7.1.9.1 Analytical Precision

Qualification of laboratory results due to exceedance of criteria associated with measurements of precision will be accomplished by determining relative percent differences (RPDs) through sample splits and duplicate analyses. The following equation will be used to calculate the RPD:

$$RPD = (C_1-C_2) \times 200\% / (C_1+C_2), \text{ where:}$$

C_1 = larger of the two concentrations
C_2 = smaller of the two observed concentrations.

Analytical and environmental variability will be assessed via blind replicate sample results. These data will be used to determine the overall precision and variability associated with the entire analytical and sampling process. It is anticipated that environmental variability will exceed that due to the analytical process alone. Attempts will be made to quantify the amount of environmental and laboratory variabilities.

7.1.9.2 Analytical Accuracy

Analytical accuracy will be assessed in terms of analyte recoveries determined during spiked sample analyses and with the use of commercially available reference materials (i.e., SRMs and CRMs). For spiked samples, the percent recovery (%R) can be used as a direct measure of accuracy.

$$\%R = (S-U) \times 100\% / C_{SA}, \text{ where:}$$

S = measured concentration in spiked sample
U = measured concentration in unspiked sample
C_{SA} = actual concentration of spike added.

Laboratory results will be assessed and qualified in accordance with CLP requirements by the use of surrogate compound recoveries for organic compounds and matrix spike recoveries for inorganic parameters.

7.1.9.3 Analytical Completeness

Analytical completeness will be assessed as the ratio of acceptable measurements obtained to the total number of planned measurements for an activity. Completeness (C) is defined as:

Percent C = (No. of data points within target QC limits) x 100% / (Total No. of data points)

7.1.10 Corrective Actions

Continuous data assessment and comparison of data precision, accuracy, and completeness to the data acceptance criteria and project DQOs will be undertaken. The Laboratory QA Coordinator will keep the Project Chemist apprised of the laboratory's QC status during all analytical events. Any significant or consistent deviation from acceptance criteria and analytical goals will be followed by an assessment of the problem and institution of corrective action. Specific corrective actions are outlined in each respective CLP SOW or laboratory SOPs and include but are not limited to the following:

- Identify the source of the nonconformance
- Reanalyze sample(s) if holding time criteria permit
- Retrieve archived sample(s) for analysis (each sample collected has an associated archived sample for use as sample backup, primarily for extractable organics and/or metals analyses)
- Reanalyze sample(s) following resampling
- Evaluate and/or amend sampling and analytical procedures
- Accept noncompliant data and apply qualifier(s) to indicate level of uncertainty.

7.1.11 Quality Assurance Reports to Management

Monthly QA reports will be prepared by the laboratory and delivered to the analytical chemistry QA manager and the Sediment Characterization Task Manager. These reports will include the following:

- Inventory and status of samples held at the laboratory
- Summaries of out-of-control laboratory QC data and any corrective actions implemented
- Descriptions and justification for any significant changes in QA/QC procedures
- Any changes to or deviations from SOPs
- Any changes in lab procedures that could affect data quality

- Summary of project-related communications regarding sample handling and analyses.

After data delivery and validation, a report concerning data quality for each analytical task will be generated under the management of the analytical chemistry QA manager. This report will summarize the quality of validated data, present results of system and performance audits, and assess data usability for the project.

7.2 LABORATORY METHODS FOR CONTAMINANT MOBILITY

Core seals will be checked upon arrival at the Soil Technology laboratory, and the cores will be stored at 4°C. To the extent possible, cores will remain inclined at 45 degrees to upright at all times. Core sample extrusion and compositing will be done under a nitrogen atmosphere in a glove box/bag. Sample handling methods to achieve this requirement were developed by Soil Technology. They involve placing the compositing pan, equipment, and sample jars in a large glove bag; attaching and sealing the glove bag to the end of core tube; inflating the bag with nitrogen; carefully siphoning off the overlying water while introducing nitrogen gas at the top of the tube; extruding, homogenizing, and compositing the sediment into the sediment pan; and placing homogenized, composited sediment into pre-cleaned jars with airtight PTFE (Teflon)-lined lids which are stored at 4°C. The cores will be visually classified during the extrusion process.

Both sediment and aqueous samples will require chemical analysis for the contaminant mobility predictions. For sediments, the analytical methods, QC measurements and criteria, and reportables/deliverables are based upon CLP requirements, PSEP guidance, and PSDDA requirements. Very low detection limits for aqueous (leach water) samples are required for the contaminant mobility study because past projects have demonstrated that the mobile compounds occur in low concentrations. Some of the special requirements for these aqueous chemical analyses as well as sediment chemical analyses are summarized below.

7.2.1 Sediment Chemical Analysis

The analytes and analytical methods to be used on sediment samples are identified in Table 6. The laboratory methods and QA for conventionals and chemicals of concern are discussed in the previous section (7.1.2).

7.2.2 Aqueous Chemical Analyses

Preliminary analytes and analytical methods to be used on aqueous samples are identified in Table 7. The laboratory methods and quality assurance requirements are discussed in Section 7.1.1.

7.2.3 Aqueous Sample Preparation

Soil Technology will perform the contaminant mobility extraction procedures with technical guidance provided by Converse Consultants NW. Extraction procedures are based on published reports from the Environmental Laboratories of the U.S. Army Corps of Engineers Waterways Experiment Station (WES).

7.2.3.1 Leach Tests (Sequential Batch Leach Test, Column Leach Test, and Porewater Extraction)

The leach tests combine sequential batch leach tests, column leach tests, and porewater extraction tests to evaluate contaminant mobility. The leach water used in the sequential batch leach tests and column leach tests will be a laboratory-prepared solution of deoxygenated and distilled-deionized water, which is used to predict the leachate quality from a saturated anaerobic nearshore confined disposal facility (Myers et al. 1992).

Sequential Batch Leach Tests -

Sequential batch leaching is a procedure for determining how the equilibrium distribution of a contaminant between the solid phase and aqueous phase changes during leaching with fresh water. By sequentially leaching an aliquot of sediment solids, solid phase contaminant concentrations and aqueous phase contaminant concentrations can be measured and used to generate a desorption isotherm, and to determine the relative contribution of contaminant from colloidal release to the leachate.

1) **Organic Extractions.** Sufficient volume of homogenized sediment and leach water, under nitrogen atmosphere, is transferred into a pre-cleaned 450-milliliter stainless steel centrifuge tube to obtain a final water-to-sediment ratio of 4:1 with an approximate sediment solids concentration of 250 grams per liter in 350 to 400 milliliters of total volume. The tubes are sealed with leakproof airtight tops, placed in a rotary tumbler (Garrett et al. 1984), turned end over end at 40 revolutions per minute for 24 hours, and centrifuged for 30 minutes at 6,500 gravitation constants (*g*). A small aliquot of the supernatant will be collected for conductivity analysis. The supernatants will be filtered under nitrogen atmosphere through a pre-combusted (400°C) Whatman GF/D prefilters and one micron

Gelman A/E binder-free glass fiber filters into a pre-cleaned glass bottle (USACOE 1986; Brannon et al. 1991).

This procedure is repeated six times for a total of seven extractions with the addition of fresh leach water to the centrifuged sample to establish the same water-to-sediment ratio 4:1. All seven of the extractions will be analyzed. Procedure blanks, trip blanks, and duplicate samples (if sample size permits) will be collected and analyzed for QA. All sample handling, extractions, filtering, and centrifugation will be conducted at the *in situ* temperature if possible.

2) Inorganic Extractions. Under nitrogen atmosphere, sufficient homogenized sediment from each of the sediment sampling stations will be placed in two pre-cleaned 250-milliliter polycarbonate centrifuge tubes along with leach water to obtain a final water-to-sediment ratio of 4:1 with an approximate sediment solids concentration of 250 grams per liter in 200 milliliters of total volume per tube. Two tubes are needed to collect the necessary volume required for the inorganics analyses.

The bottles will be sealed with leakproof airtight tops, placed in a rotary tumbler (Garrett et al. 1984), turned end over end at 40 revolutions per minute for 24 hours, and centrifuged for 30 minutes at 13,000 *g*. The supernatants from individual stations will then be filtered and combined under nitrogen atmosphere. Filtering will be accomplished using pre-combusted (400°C) Whatman GF/D prefilters and one micron Gelman A/E binder-free glass fiber filters into a pre-cleaned glass bottle (USACOE 1986; Brannon et al. 1991).

An approximately 10-milliliter aliquot of each filtered extraction will be analyzed in the glove box for pH, Eh, conductivity, and dissolved oxygen. A second 10-milliliter aliquot is taken for chloride analysis. The remaining metals aliquot will be acidified with 1 milliliter Ultrex® grade concentrated HNO_3 per 100 milliliters of sample to prevent ferric iron precipitation and scavenging of organics, and then stored in the dark (USACOE 1986; Brannon et al. 1991).

This procedure is repeated six times for a total of seven extractions with the addition of fresh leach water to the centrifuged sample to establish the same water-to-sediment ratio of 4:1. All seven of the extractions will be analyzed. Procedure blanks, trip blanks, and duplicate samples (if sample size permits) will be collected and analyzed for QA. All sample handling, extractions, filtering, and centrifugation will be done at the *in situ* temperature if possible.

Column Leach Tests -

Although sequential batch leach tests are useful for determining desorption, equilibrium distribution, and long-term leaching characteristics, they cannot simulate advective-dispersive and other mass transfer effects on leachate quality. The primary purpose of column leaching is to demonstrate, on the laboratory scale, that the local equilibrium assumptions and data from batch tests can be used to predict contaminant leaching in a nearshore confined disposal facility. The details of the column leach test procedure are presented in the following section.

The design recommendations for the WES column leaching apparatus (Myers et al. 1991) are used with some modifications. Two columns, one for organic extraction and one for inorganics, will be weighed empty, purged with nitrogen gas, and then loaded with homogenized composite sediment under nitrogen atmosphere. The columns are sealed with airtight caps or fittings and reweighed to determine the total pore volume.

Each column will be connected through a constant volume pump (Fluid Metering, Inc. pump suggested by Tommy Myers) via Teflon® tubing to its own supply of leach water. Flow rates will be maintained below 10^{-5} cm/sec through the column in an upflow configuration. The leach supply water will be maintained under a positive nitrogen atmosphere and the column will be airtight to ensure anoxic conditions. The supply water and the leachate column will be maintained at the *in situ* temperature during the extractions.

The pre-cleaned sample collection vessels will be fitted with a stopper and a Teflon® inlet and outlet tube to be airtight. Each vessel will be purged with nitrogen gas just prior to attachment to the column. The sample vessel inlet tube will be immediately attached to the column outlet while the sample vessel outlet tube is immediately placed in a water trap, which will allow the gas to escape from the sample vessel without exposing the leachate to the atmosphere.

After the appropriate amount of sample has been collected (ca. 500 milliliters each for inorganics and organics), a new purged sample vessel will be immediately attached to the column and the previously attached vessel's tube ends sealed. The sample volume and time of collection are recorded. Filtering through pre-cleaned one micron Gelman A/E binder-free glass fiber filters into the sample vessels will be accomplished in-line on the exit port of the column.

A filtered 10-milliliter aliquot from the inorganics column prior to acidification will be analyzed in the glove box for pH, Eh, conductivity, and dissolved oxygen. A second 10-milliliter aliquot will be collected for chloride analysis. If in-line filtering is not possible, then the sample will be filtered through pre-cleaned one micon Gelman A/E binder-free glass fiber filters into pre-cleaned sample containers under nitrogen atmosphere.

The remaining filtered sample will be acidified with 1 milliliter of Ultrex® grade concentrated HNO_3 for inorganics, and 1 milliliter of Ultrex® grade concentrated HCl per 100 milliliters of sample for organic leachate samples. All samples will be stored in darkness.

This column sampling protocol requires that the samples will be adequately preserved in their anaerobic state during the period of collection. The latest WES column leaching studies (Myers et al. 1992) are preserving metals by daily adjustment of pH to less than 2 using concentrated nitric acid. The organics are extracted in the sampling jugs to ensure that all of the analyte is included in the sample. Both of these precautions mitigate the potential for ferric iron flocculation caused by oxygen in the air, which will scavenge metals and organics in the floc. If an anaerobic system cannot be maintained, then the flocculation problem will be addressed. Every effort will be made to ensure that the sample remains in an anaerobic state during sample collection. Sample collection vessels will be constantly monitored for signs of flocculation or other changes.

Previously recommended sampling frequencies have been three to four samples from the first pore volume and one to two samples per pore volumes thereafter (USACOE 1986). For this project, it is suggested that sampling occur at intervals of approximately 0.5 pore volumes for up to 20 pore volumes. Only 10 of these samples will be submitted for analysis based on the conductivity, chloride, Eh and pH measurements. One laboratory blank and one rinsate sample from each of the columns will be submitted for analysis. The rinsate blank uses deoxygenated distilled-deionized water passed through the entire apparatus, including the filter assembly.

Porewater Extraction -

The porewater extraction follows the procedure from the sequential batch leach tests except that leach water is not added to the samples. Instead, a series of at least four of the appropriate centrifuge tubes for organics and inorganics is loaded with the homogenized sediment from the same station under nitrogen atmosphere, sealed, and centrifuged. The number of tubes depends on the porewater yield. Sufficient sediment is used to collect about 400 to 500 milliliters for organics and inorganics analyses.

The stainless steel tubes for organics are centrifuged at 6,500 *g* and the polycarbonate tubes for inorganics are spun at 13,000 *g* for 30 minutes. The tubes are filtered, and the supernatants are combined under nitrogen atmosphere and filtered using pre-combusted

(400°C) Whatman GF/D prefilters and Gelman A/E binder-free glass fiber filters into a pre-cleaned glass or plastic bottle.

A small amount of leachate will be set aside for analysis of pH, Eh, chloride, conductivity, and dissolved oxygen. The leachate is acidified for organic analysis with 1 milliliter of concentrated Ultrex® grade HCl per 100 milliliters of sample and for inorganic analysis with 1 milliliter of concentrated Ultrex® grade HNO_3 per 100 milliliters of sample. Samples are stored in a cool, dark location. Pre-cleaned glass bottles will be used for storage of organic samples; organic samples will be filled to the top. Pre-cleaned plastic bottles will be used for inorganic samples.

7.2.3.2 Standard and Modified Elutriate Tests

The standard elutriate test is intended to provide information on placement of mechanically dredged sediment behind a partially completed berm with no weir structure, following the protocol from the Ocean Testing Manual (EPA, 1991).

The standard elutriate test procedures are as follows:

- Mix 20 percent by volume undisturbed bottom sediments with 80 percent by volume site water from the dredging site
- Vigorously agitate using mechanical shaker for 30 minutes
- Release compressed air through a diffuser tube while shaking to offset the potential oxygen demand exerted by the sediments
- Allow the mixture to settle for 1 hour
- Collect, centrifuge (or filter through a 0.45-μm filter), and analyze the elutriate (supernatant). The elutriate from the bottom samples can then be compared with a corresponding analysis of water samples taken while dredging.

The modified elutriate test is intended for hydraulically dredged sediment placed in a completed nearshore confined disposal facility and uses a different soils:water ratio than the standard elutriate test. The protocol is from t Technical Note EEDP-04-2. Either or both of these tests may be requested on this project.

All QA protocols concerning preparation, contamination avoidance, and sample preservation will be strictly adhered to. Samples are packaged cold and shipped to the analytical laboratory immediately subsequent to sampling. Site water and elutriate samples will be analyzed for total and/or dissolved constituents and total suspended solids.

7.2.3.3 Column Settling Tests

The 15-day column settling test, zone settling test, and flocculent settling test is run in the same 8-foot settling column for each composite sample, following the protocol in the Engineering Manual, Confined Disposal of Dredged Material (USACOE, EM1110-2-5027; 1987 as amended by Technical Note EEDP-2-05).

The water used for the column settling test is the water from the sampling site. The sediment is mixed with the site water such that when pumped into the column, it will have a solids concentration that is similar to the influent concentration of the dredge. The actual total solids concentration in the column is measured to the nearest 0.01 gram per liter.

Total suspended solids and turbidity are measured from samples taken from the supernatant water. Total suspended solids is measured to the nearest 0.1 milligram per liter, and turbidity is measured to the nearest 0.01 nephelometric turbidity unit. Total suspended solids and turbidity measurements are made immediately after sampling. Sediment heights measured in the solids zone are measured to the nearest 0.005 foot.

7.2.4 Quality Assurance Procedures for Contaminant Mobility Tests

Detailed step-by-step procedures along with data recording sheets are used for each of the contaminant mobility tests. These procedures have been developed by Soil Technology based on the test protocols. The data sheets are monitoring daily by the laboratory manager and spot checked for accuracy and discrepancies. The data sheets are then entered into electronic spreadsheets where calculations of volume, weight, and flow rate are made. Any discrepancy in the calculated values or measured values (e.g., large change in Eh or pH) are brought to the attention of the Contaminant Mobility QA Manager. Corrective measures range from correcting transcription errors, to adding additional samples, to re-running an entire series of samples. The QA Manager has the responsibility for approving the corrective action.

Quality control samples for analytical testing from the extraction tests will include equipment blanks, which are the same as the procedure and rinsate blank discussed in the preceding text, and field blanks which are the same as laboratory blanks. Duplicate samples will be run for the sequential batch and porewater extraction tests as well as for the elutriate tests. These samples will be submitted as blind samples to the analytical laboratory.

All samples will be labeled with the appropriate identification as to the type of test, the sample sequence number, the date and time of sampling, identification of the person filling in the label, and the type of sample and laboratory. Chain-of-custody records will be maintained for every sample collected. Sample custody will be maintained by Soil Technology until the samples are turned over to the shipper or the analytical laboratory. Samples will be shipped to the analytical laboratory in ice chests with custody seals as described in Section 6.4.2.

QA procedures for chemical analyses associated with contaminant mobility tests are the same as those for analytical chemistry (Section 7.1).

7.3 LABORATORY METHODS FOR TOXICITY TESTS

Under certain conditions, biological sediment characterizations will be conducted to test and evaluate the sediment samples relative to both the Washington State Sediment Management Standards (WAC 173-204) and the dredged disposal suitability criteria defined under the Puget Sound Dredged Disposal Analysis program (PSDDA 1988, 1989). The following sediment bioassays will be conducted when bioassay testing is indicated (see Section 4.4.2):

- 10-day amphipod bedded sediment test using *Rhepoxynius abronius* or *Ampelisca abdita*
- 20-day polychaete growth test using *Neanthes arenaceodentata*
- The echinoderm larval sediment elutriate test using *Dendraster excentricus*
- The Microtox® Saline-extract test (subsurface cores only).

Procedures for sampling, handling, testing, and analysis are discussed below.

7.3.1 Pre-testing Quality Assurance Procedures

To ensure the production of technically defensible biological data, a QA/QC program will be instituted prior to initiation of bioassays. This program has included a rigorous selection process for the contracting laboratory, and the creation and review of a bioassay project-specific QAPP by the contracting laboratory. It will also include pre- and during-test laboratory audits, as well as use of project-specific QC checklists and data bench sheets. The elements of this QA/QC program are discussed below.

7.3.1.1 Selection of Bioassay Laboratories

Parametrix, Inc. of Kirkland, Washington and Northwest Aquatics of Newport, Oregon were selected to perform bioassays following a competitive bid process. Each laboratory has an extensive record of performing the bioassay tests required for pre-remedial design.

7.3.1.2 Project-Specific Quality Assurance Program Plan and Test Protocols

The QAPPs prepared by Parametrix and Northwest Aquatics, and their test protocols, are found in Appendix C. The methods specified in these documents meet the guidelines established by PSDDA, and will be followed for pre-remedial design.

7.3.1.3 Performance Audits

An audit of the laboratory will be conducted by the sediment toxicity QA manager prior to commencement of testing. This will include a tour of the physical facility and review of the lab's QA/QC program, SOPs, and project filing system. Interviews will also be conducted with laboratory staff. The audit will be conducted using guidance from EPA's *Manual for the Evaluation of Laboratories Performing Aquatic Toxicity Tests* (EPA 1990), and the U.S. Army Corps of Engineers' *Guidance for Contracting Biological and Chemical Evaluations of Dredged Material* (Sturgis 1990). A formal audit report will be issued, and the lab will be expected to comply with the requests of the QA manager. The audit report will be part of the technical memoranda.

In addition to the pre-test audit, unannounced spot audits will be conducted during the performance of the tests. During these spot tests, the lab will be expected to allow the auditor to have complete access to the lab and its personnel.

7.3.1.4 Test Quality Control Checklists

Quality control checklists will be used by the laboratory to ensure that all procedural and data elements of the tests will be followed and recorded. An example of these checklists may be found in Appendix D. The checklists also include specific bench data sheets. These checklists have been recommended for use by the U.S. Army Corps of Engineers in the *QA/QC Guidance for Laboratory Dredged Material Bioassays* (USACOE WES 1993, Draft).

For each batch of bioassays, the lab will initiate these checklists. Lab staff are required to complete all elements of the checklists, and the original lists will be submitted as a deliverable in the final data package.

7.3.2 Test Procedures

General guidance for conducting biological testing in Puget Sound may be found in the revised Puget Sound Estuary Protocols (PSEP 1991), with applicable modifications identified under the PSDDA (1990) program. The following sections discuss both general and test-specific methods and performance criteria.

7.3.2.1 General

All general criteria defined by PSEP (1991) will be applied to this program. In addition, the following project-specific criteria will be used:

- All tests will be conducted within 8 weeks from the time of sediment collection. Holding conditions will be 4°C in the dark. Samples with any remaining headspace will be stored under nitrogen.

- A full priority pollutant scan will be run on the seawater used for testing. All measured analytes in the test seawater must be less than the applicable EPA marine chronic water quality criteria. The analysis will be included as a part of the final deliverable package. If multiple sources of seawater are used, an individual analysis will be required for each source.

- All physical/chemical measurements will be taken from a surrogate sixth replicate at the time of inoculation, and at the conclusion of the amphipod, *Neanthes*, and *D. excentricus* tests.

- The lab will incorporate a completely randomized design for replicate placement in water baths or growth chambers.

- Total ammonia and sulfides will be measured at the time of inoculation and at test termination for the amphipod, *Neanthes*, and *D. excentricus* tests.

- Positive control tests that exceed the UWL or UCL will be brought to the immediate attention of the bioassay QA manager, the sampling and analysis QA manager, and the HCC and EPA project coordinators.

7.3.2.2 Control and Reference Sediments

Control sediments for most bioassay testing will be collected from West Beach (Whidbey Island, WA). Control sediments for *Ampelisca abdita* will come from the test organisms' collection site. Control tests are used to assess the relative health of the test species. During late summer and early fall, West Beach control sediments may experience unusual test mortality. To reduce the chance of test failure, the West Beach control sediments may be gently washed to remove organic material. In past years, use of this procedure for the PSDDA program has reduced control mortality to levels typical of the rest of the year. In the event that pre-remedial design sediments are washed, a second set of unwashed control sediments will also be tested.

Reference sediments for bioassay testing will be collected from Puget Sound reference locations that have been approved by PSDDA. The selection of reference sediment collection areas will be coordinated with EPA and the PSDDA agencies through the DMMO. It is anticipated that stations within Carr Inlet will be selected for sampling.

Reference sediments will contain approximately the same sediment grain size (i.e., percent fines) as the test sediment. To ensure a reasonable grain size match, potential reference sediments will be wet sieved during collection. Results of wet-sieving that are within the range of percent fines ± 10 percent will be considered acceptable. More than one reference station may be required to cover the range of grain sizes found in Hylebos Waterway. Reference sediments will be analyzed for grain size, total organic carbon, total sulfides, total solids, total volatile solids, and ammonia using methods provided in Section 7.1. Additional sediment will be archived for potential chemical analysis. This sediment could be analyzed if unexplainable reference sediment failures were noted.

Performance criteria for control and reference sediments are provided in Tables 17-20. If these criteria are exceeded, the bioassay QA manager will involve the HCC and EPA project coordinators and the PSDDA agencies in the evaluation of the data. In past PSDDA projects, there have been occasions when control sediments have slightly exceeded the criteria but reference and test sediments have both passed. Based on best professional judgement, the PSDDA agencies accepted the data. In the event that similar situations arise during pre-remedial design, best professional judgement will be applied, in consultation with EPA and PSDDA, to determine whether the test results pass the corresponding criteria.

7.3.2.3 Ten-Day Amphipod Bedded Sediment Test

These tests will be conducted with either *Rhepoxynius abronius* or *Ampelisca abdita*, depending upon the physical conditions of the test sediments. *R. abronius* is the preferred test species and will be used on all test sediments having a combined percent fines (silts + clays) of $\leq$ 60 percent. *A. abdita* will be used for those sediments having percent fines > 60 percent. The decision criteria for determining test performance (i.e., pass/fail) will be applied uniformly to both species.

A summary of the test conditions and test acceptability criteria for the amphipod test are found in Table 17. Taxonomic verification of the test organisms will be conducted on specimens from at least one collection or shipment.

7.3.2.4 Echinoderm Larval Test

These bioassays will be conducted using larvae of the eastern Pacific sand dollar, *Dendraster excentricus*. Test conditions and acceptability criteria for this procedure are found in Table 18. Program-specific procedures and criteria for the *D. excentricus* test are as follows:

- All seawater used in the larval test must be collected within 8 hours of use in the tests.

- The control performance acceptability criteria in this program will be ≥ 70 percent normal larvae and ≤10 percent abnormal larvae. Failure to achieve this level will require a retest.

- For each control, reference, and test replicate, three 10-milliliter aliquots will be withdrawn and preserved at test termination. Two of those aliquots will be counted and the data submitted with the final report. The third aliquot will be archived by the lab for a period of up to 1 year beyond the submittal of the final data package.

7.3.2.5 20-Day *Neanthes* Growth Test

N. arenaceodentata is the test organism for this bioassay. Test conditions and acceptability criteria for this procedure are found in Table 19. Particular attention will be given to ensuring that the specified initial age and weight of the test organisms are observed. There are no additional special conditions attached to this test.

7.3.2.6 Microtox Saline-Extract Test

Test conditions and acceptability criteria are found in Table 20. In conducting this analysis, a dilution series is run on the sediment extract, and a total of five replicates are required at the highest dilution concentration. Reference material is to be run with each batch, with a batch being defined as all tests conducted on a single lyophilized vial of test bacterium. Tests will be conducted within 2 hr of reconstituting the bacteria.

7.3.3 Data Reporting Requirements

Upon completion of all testing, the lab will submit a report that includes the data listed below. The report will be provided both in hard copy and magnetic media (DOS-compatible).

- Survival of test organisms in each test container expressed as the number of test organisms alive, number dead, number missing, and the proportion surviving.
- The mean percent survival, standard deviation, and variance for each test sediment.
- For the echinoderm test, number of normal and abnormal larvae recovered from each test vessel.
- For the *Neanthes* growth test, raw data including average weight of test organisms recovered in each test vessel.
- For the Microtox® test, raw data including the gamma values for each test replicate at all concentrations.
- Water quality measurements, including ammonia and sulfides. Accompanying the ammonia and sulfide data, the lab will also supply the associated instrument calibration and results for seawater spikes.
- Interstitial water salinity values
- 96-hour LC_{50} values with 95 percent confidence intervals for the reference toxicant. Method of calculating the LC_{50} will also be included.
- Results of the priority pollutant scan(s) conducted on the seawater used in the tests.
- Any problems or deviations from the protocols, SOPs, or the SAP that may influence test results or data quality.
- Copies of all lab QC checklists for each bioassay.

7.3.4 Quality Assurance Review of Lab Data

All data submitted by the laboratory will be subject to a quality assurance review. QA guidelines for bioassay data review procedures that will be followed in this program are adapted from Sturgis (1990), PTI (1989), and WES (draft, 1993). An example of the QA review checklist is found in Appendix E. At a minimum, the submitted data will be reviewed for the following:

- **Data Completeness.** Defined as the amount of data obtained versus the amount of data originally intended to be collected. For this program, 80 percent will be considered acceptable.

- **Data Quality Objectives.** Data will be reviewed for compliance with the acceptable parameters established in the specific test protocols. These may include, but are not limited to the following:

  - Tests conducted within specified holding times
  - Test organism mortalities/abnormalities exceeding performance criteria
  - Out-of-range water quality parameters
  - Lack of randomization
  - Lack of required reference, control, or reference toxicant exposures
  - Reference toxicant results outside of specified ranges.

7.3.5 Corrective Action for Unacceptable Data

Tests that do not meet completeness and DQO objectives will either be qualified or be rerun. The conditions under which data will be qualified or tests rerun are shown in Table 21.

7.4 LABORATORY METHODS FOR BENTHIC INFAUNA

Marine Taxonomic Services, Ltd. of Corvallis, Oregon will perform the laboratory services for benthic infauna. The procedures outlined below are generally consistent with Puget Sound Estuary Program protocols and guidelines (PSEP). The laboratory's QA plan is found in Appendix F.

7.4.1 Rescreening Procedure

Samples will be kept in the formaldehyde-seawater mixture for a minimum period of 24 hours and a maximum of 14 days to allow for the proper fixation of animal tissue. Caution will be exercised when handling formaldehyde mixtures due to its toxicity (Kitchens et al. 1976).

When rinsing formaldehyde from the sample, a screen one screen size smaller than that used in the field will be used (i.e., a 1.0-mm sieve in the field and a 0.5-mm sieve in the laboratory). This will ensure that any material obtained during field sampling will be retained, regardless of shrinkage or breakage of organisms resulting from preservation. Since formaldehyde is toxic, its safe disposal is an absolute necessity in any benthic sampling program. The Puget Sound Protocols do not describe handling procedures for residual formaldehyde. The following procedure was developed and is currently used by the Washington Department of Ecology for the Marine Sediment Monitoring Task of the Puget Sound Ambient Monitoring Program and will be followed in this program

All personnel handling samples with formaldehyde will read the material safety data sheet prior to commencing operations. Personnel involved in the rescreening procedure will wear protective clothing (hooded Tyvek coveralls), rubber gloves, waterproof boots, and fit-tested respirators.

The formaldehyde/seawater in the sample container will be carefully decanted through a 0.5-mm mesh Tyler sieve screen and funnel apparatus directly into a 55-gallon drum. The sieve screen will be flushed with fresh water to remove any residual formaldehyde/seawater mixture. The sample will then be gently rinsed in a succession of three 5-gallon buckets filled with fresh water. This procedure will be followed with every sample until all samples have been rinsed. The 55-gallon drum of formaldehyde/seawater mix will be disposed of in the proper manner for a hazardous chemical.

The sample will then be transferred to a glass jar and the jar filled with 70 percent ethanol. Each jar will have two external labels and one internal label. The internal label will be written with an indelible ink pen on waterproof 100 percent rag paper. The two external labels will be printed using an indelible ink pen. One label will be attached to the side of the jar and the second to the lid of the jar. The sample rescreening log will be completed at the time of transfer. An example of a rescreening log is presented in Table 22.

7.4.2 Sample Sorting

The standard technique for sorting samples involves placing a teaspoon of the sample in a petri dish and, while viewing the sample through a 10 power dissecting microscope, removing each organism or fragment. Each petri dish will be sorted twice to ensure that all organisms are removed. The organisms will be sorted into the following taxonomic groups: Annelida, Crustacea, Amphipoda, Mollusca, Ophiuroidea, other Echinodermata, and other phyla. All organisms will be stored in a 70 percent ethanol solution except for the Ophiuroidea, which require air drying for identification. Each vial will have an internal data tag with the survey name, station designation, water depth, date sampled, and field screen size. All pertinent information will be recorded on the sample sorting form (Table 23).

7.4.3 Identification of Organisms

Sorted organisms will be identified and enumerated to two taxonomic levels, depending on station location. The first will be to the major phyla level as discussed above, and the second will be to the lowest taxonomic level possible, generally the species level. Samples from potential reference stations will be identified to the lowest taxonomic level. The identifications will be done using 10 power dissecting microscopes and a compound microscope with 10, 40, and 90 power lenses. At least two different pieces of taxonomic literature will be used for each species identification, one of which should be the original description.

Each taxonomist will record identifications on pre-printed and coded forms. These forms will allow easier entry of data into computers for analysis. The taxonomist will initial the form on completion of the sample.

7.4.4 Quality Control Requirements

The quality control procedures to be used in this program have been abstracted from PSEP (1987).

7.4.4.1 Sample sorting

Twenty percent of each sample will be re-sorted to determine sorting efficiency. The sample will be thoroughly homogenized to ensure that the re-sorted aliquot is representative of the entire sample. A sample is considered to have passed QC if the number of organisms found in the re-sort does not deviate by more than 5 percent from the original count. The re-sort will be carried out using a 25 power dissecting microscope by someone other than the original sorter. A QA/QC form is used to record the appropriate information (Table 24).

Complete records on sorting and resorting for each sample will be permanently maintained.

7.4.4.2 Identification of Organisms

The consistency of identifications among taxonomists and sampling programs is crucial to maintaining a good Puget Sound database. Internal consistency within a laboratory will be maintained by the constant informal interaction among taxonomists. Internal quality control will be maintained by checking identifications against a verified voucher collection. External verification and quality control will be maintained by having 5 percent of all samples re-identified by another equally qualified taxonomist. Specimen identification will be at least 95 percent accurate.

Complete records on identification of each sample will be permanently maintained.

7.4.4.3 Data Validation

Benthic infauna validation and verification methods include a review by the benthic infauna QA officer of the following documents:

- Sample sorting quality control report
- External taxonomic quality control report
- Verification report from outside experts on the specimen voucher collection.

Reports will be reviewed to ensure that all QC requirements have been met and that completeness is acceptable.

7.4.5 Archival Procedure

Archival procedures vary from laboratory to laboratory, and there are no specified procedures in the Puget Sound protocols. The following procedures will be followed during pre-remedial design activities.

7.4.5.1 Sorted Debris

Upon completion of all QC procedures, the remaining sediment residue will be characterized and a portion set aside for archival purposes. The characterization includes a description of the major sediment components and the volume of the material. An 8-dram (1 fluid ounce) screw cap vial will be filled three-quarters full with a representative portion of the residue. The vial will be topped off with 70 percent ethanol and the original label placed in the vial. All vials will be tightly closed and placed together in another container which will be filled with 70 percent ethanol and sealed. Plastic tape will be wrapped in a clockwise direction around the lid of the container to improve the seal and to ensure that the alcohol does not evaporate.

7.4.5.2 Identified Samples

Upon completion of all identifications and QC, the vials containing the major taxonomic groups will be topped off with 70 percent ethanol and the lids tightly sealed. Plastic tape will be wrapped around the vial to prevent evaporation. All vials from each replicate sample and station will be tied together. All samples from the survey will be placed into plastic buckets, and the lid tightly sealed and wrapped with plastic tape. Each bucket will be clearly labeled with the survey name, date, and the number and type of samples in it.

7.4.5.3 Maintenance of a Verified Voucher Collection

A verified voucher collection of the organisms found during the sampling program will be created. The collection will consist of from one to five individuals of each species. Each vial will contain organisms from only one station. A computer listing of each species name, the taxonomist who made the identification, and the name of the taxonomist who verified the identification will be recorded. The computer listing will also show when the specimen was verified, the location of the specimen in the voucher collection, the status of the specimen if it was loaned to outside experts, and references to pertinent literature.

7.4.6 Data Reporting Requirements

The following data will be reported by the benthic laboratory:

- Data forms listing the abundance of all taxa by sample
- Sorting quality control data sheets
- Results from the external taxonomic quality control
- Data on floppy disk listing the abundance of all taxa by sample
- Any problems that may have influenced data quality.

7.4.7 Performance Audits

Periodic performance audits will be conducted by the benthic infauna QA officer to ensure that the QC objectives are being met by the benthic infauna laboratory. These audits will include the resorting and re-identification of specimens. If the audits identify unacceptable laboratory practices, then corrective actions will be implemented. Results will be included in the technical memoranda.

7.4.8 Corrective Action for Unacceptable Data

Should performance audits result in identification of unacceptable sample handling procedures or data, the benthic infauna QA officer will be responsible for developing and initiating corrective action. The Program Manager will be immediately notified if the problem is of significant magnitude to affect program success. Corrective actions may include the following:

- Additional resorting of samples

- Additional re-identification of samples.

In the event that re-sampling is considered, the EPA RPM will be consulted prior to initiating re-sampling.

Table 6. Target analytes, methods of analysis and quantitation limit goals for sediments.

Analyte	CLP CRQL	PRQL	Reference Method	Method Capability
Conventionals				
Grain size analysis	NA	NA	PSEP (mod. ASTM with hydrometer)	0.01%
Atterberg limits	NA	NA	ASTM D-4318	1%
Specific gravity	NA	NA	ASTM D-854	
Gravimetric water content / Total solids	NA	NA	ASTM D-2216	< 1%
Total volatile solids	NA	NA	SM, M. 2540E	< 1%
Total organic carbon	NA	NA	PSEP (combustion/IR)/Michelson, 1992	0.1%
Ammonia	NA	NA	MCAWW, M. 350.3/Plumb 1981	50 ppm
pH	NA	NA	SW 846, M. 9040/9045	
Sulfide	NA	NA	PSEP (SM, M. 4500E)	1 mg/kg, dry
Metals	units: mg/kg, dry weight			
Antimony	12	20	CLP (ILM03.0 / ICP)	12
Arsenic	2	57	CLP (ILM03.0 / ICP or GFAA)	1-2
Cadmium	1	0.96	CLP (ILM03.0 / ICP or GFAA)	0.1-0.5
Chromium	2	270	CLP (ILM03.0 / ICP)	2
Copper	5	81	CLP (ILM03.0 / ICP)	5
Lead	0.6	66	CLP (ILM03.0 / ICP)	8
Mercury	0.1	0.21	CLP (ILM03.0 / CVAA)	0.1
Nickel	8	140	CLP (ILM03.0 / ICP)	8
Silver	2	1.2	CLP (ILM03.0 / ICP or GFAA)	0.2
Zinc	4	160	CLP (ILM03.0 / ICP)	4
Organics (semivolatiles)	units: μg/kg, dry weight			
Naphthalene	330	210	CLP, PSEP mod. (M. 3550 / 8270)	13
Acenaphthylene	330	64	CLP, PSEP mod. (M. 3550 / 8270)	13
Acenaphthene	330	63	CLP, PSEP mod. (M. 3550 / 8270)	14
Fluorene	330	64	CLP, PSEP mod. (M. 3550 / 8270)	12
Phenanthrene	330	320	CLP, PSEP mod. (M. 3550 / 8270)	8
Anthracene	330	130	CLP, PSEP mod. (M. 3550 / 8270)	11
2-Methylnaphthalene	330	67	CLP, PSEP mod. (M. 3550 / 8270)	13
LPAH [sum of Na, Acy, Ac, Fl, Ph & An, above]		610		
Fluoranthene	330	630	CLP, PSEP mod. (M. 3550 / 8270)	8
Pyrene	330	430	CLP, PSEP mod. (M. 3550 / 8270)	8
Benzo(a)anthracene	330	450	CLP, PSEP mod. (M. 3550 / 8270)	11
Chrysene	330	670	CLP, PSEP mod. (M. 3550 / 8270)	7
Benzo(b+k)fluoranthenes	330	800	CLP, PSEP mod. (M. 3550 / 8270)	8
Benzo(a)pyrene	330	680	CLP, PSEP mod. (M. 3550 / 8270)	11
Indeno(1,2,3-c,d)pyrene	330	69	CLP, PSEP mod. (M. 3550 / 8270)	13
Dibenzo(a,h)anthracene	330	120	CLP, PSEP mod. (M. 3550 / 8270)	13
Benzo(g,h,i)perylene	330	540	CLP, PSEP mod. (M. 3550 / 8270)	12
HPAH [sum of Flua, Pyr, B(a)A, Chr, BFl, B(a)P, I(123cd)P, D(a)A & B(ghi)P, above]		1,800		
1,3-Dichlorobenzene	330	170	CLP, PSEP mod. (M. 3550 / 8270 / 8260)	14
1,4-Dichlorobenzene	330	26	CLP, PSEP mod. (M. 3550 / 8270 / 8260)	14

Analyte	CLP CRQL	PRQL	Reference Method	Method Capability
1,2-Dichlorobenzene	330	19	CLP, PSEP mod. (M. 3550 / 8270 / 8260)	14
1,2,4-Trichlorobenzene	330	13	CLP, PSEP mod. (M. 3550 / 8270 / 8260)	8-14
Hexachlorobenzene	330	23	CLP, PSEP mod. (M. 3550 / 8270 / 8080)	14
PCB's, total [summation of mixtures]	80-160	130	CLP, PSEP mod. (M. 3550 / 8080)	20-40
Hexachlorobutadiene	330	11	CLP, PSEP mod. (M. 3550 / 8270 / 8260)	10-27
Hexachloroethane	330	1,400	CLP, PSEP mod. (M. 3550 / 8270)	27
Dimethylphthalate	330	160	CLP, PSEP mod. (M. 3550 / 8270)	14
Diethylphthalate	330	97	CLP, PSEP mod. (M. 3550 / 8270)	14
Di-n-butylphthalate	330	1,400	CLP, PSEP mod. (M. 3550 / 8270)	12
Butylbenzylphthalate	330	470	CLP, PSEP mod. (M. 3550 / 8270)	13
Di-n-octylphthalate	330	6,200	CLP, PSEP mod. (M. 3550 / 8270)	14
bis(2-Ethylhexyl)phthalate	330	1,300	CLP, PSEP mod. (M. 3550 / 8270)	10
Dibenzofuran	330	54	CLP, PSEP mod. (M. 3550 / 8270)	13
N-Nitrosodiphenylamine (as diphenylamine)	330	28	CLP, PSEP mod. (M. 3550 / 8270)	14
Phenol	330	120	CLP, PSEP mod. (M. 3550 / 8270)	16
2-Methylphenol	330	20	CLP, PSEP mod. (M. 3550 / 8270)	14
4-Methylphenol	330	120	CLP, PSEP mod. (M. 3550 / 8270)	14
2,4-Dimethylphenol	330	29	CLP, PSEP mod. (M. 3550 / 8270)	16-27
Pentachlorophenol	1,600	100	CLP, PSEP mod. (M. 3550 / 8270)	69
Benzyl alcohol	330	25	CLP, PSEP mod. (M. 3550 / 8270)	40-68
Benzoic acid	1,600	400	CLP, PSEP mod. (M. 3550 / 8270)	130
Extractables TIC's [tentatively identified compounds by GC/MS]			CLP	
p, p'-DDE	16	6.9	CLP, PSEP mod. (M. 3550 / 8080)	2
p, p'-DDD	16	6.9	CLP, PSEP mod. (M. 3550 / 8080)	2
p, p'-DDT	16	6.9	CLP, PSEP mod. (M. 3550 / 8080)	2
total DDTs		6.9		
Aldrin	8	10	CLP, PSEP mod. (M. 3550 / 8080)	1
Chlordane [sum of alpha and gamma]	80	10	CLP, PSEP mod. (M. 3550 / 8080)	2
Dieldrin	16	10	CLP, PSEP mod. (M. 3550 / 8080)	2
Heptachlor	8	10	CLP, PSEP mod. (M. 3550 / 8080)	1
Lindane [gamma-BHC]	8	10	CLP, PSEP mod. (M. 3550 / 8080)	1
Tributyltin		30	M. 3510/8270, Krone 1989 (GC/MS-SIM)	20-25
Organics (volatiles)				
Tetrachloroethylene	5	14	CLP (P & T, GC/MS, [M. 8260])	1-3
Trichloroethylene	5	160	CLP (P & T, GC/MS, [M. 8260])	1-3
Ethylbenzene	5	10	CLP (P & T, GC/MS, [M. 8260])	1-3
Xylenes, total	5	12	CLP (P & T, GC/MS, [M. 8260])	1-3

PRQL (Project Required Quantitation Limit) is the lowest value of either the sediment quality objective (SQO) or the PSDDA sediment screening level (SL). Laboratory and implemented method(s) are required to demonstrate, when practical, that the PRQL (dry weight normalized) presented here is at least 2-3 times greater than the minimum quantitation limit achieved on real sediment samples.

Reference Method is the analytical method required to achieve the project DQO's. The methods cited are sufficient to meet PSDDA requirements and have been documented to routinely achieve the minimum quantitation levels found under Method Capability for low to moderately contaminated sediment samples from Puget Sound and associated embayments (these methods have been used to support PSDDA and/or PSAMP monitoring). Some sediment samples, primarily from highly contaminated environments, may not allow the determination of some analytes at the PRQL due to chemical interferences. Chemical interferences, in most cases, should result in associated exceedances of Chemical Decision Criteria for other analytes. For organic compound analytes, either CLP or SW 846 methods may be used, as they are comparable. However, QC requirements will remain consistent with the CLP, and the analytes are restricted to those identified in this table.

Parameters requiring summation of individual constituents will be calculated by summing concentrations above detection limits. Nondetects will not normally be included with detected concentrations. If all individual analytes are reported as nondetects, then the highest nondetected value will be reported as the summation nondetected value. However, if one of the constituents is nondetected at a level which is greater than the sum of the detected constituents, this nondetected value may be used if it exceeds the next highest regulatory threshold.

SM = Standard Methods for the Examination of Water and Wastewater

CLP = U.S. EPA Contract Laboratory Program, IFB/SOW (most recent SOW or that version the laboratory has documented acceptable experience/performance)

PSDDA = Puget Sound Dredge Disposal Analysis program

PSEP = Puget Sound Estuary Program guidance (PSEP 1989a,b)

PSAMP = Puget Sound Ambient Monitoring Program, Marine Sediment Monitoring Task

ASTM = American Society of Testing and Materials

Krone 1989 = C.A. Krone, et. al. "A Method for Analysis of Butyltin Species and Measurement of Butyltins in Sediment and English Sole Livers from Puget Sound", in *Marine Environmental Research* 27, p. 1-18; 1989. In order to achieve required detection/quantitation limits, GC/MS utilizing selected ion monitoring (GC/MS-SIM), rather than full scan acquisition is necessary.

Table 9. Sample containers, preservation, and holding times for sediments and water.

Analyte [1]	Containers [2]		Preservation	Holding Time	
	Type	Size		Prep.	Analysis
Sediments					
Grain size	G	16 oz.	4°C	-	180 days
Metals, except Hg	G/p	8 oz.	4°C	-	180 days
Mercury				-	14 days
Total volatile solids				-	14 days
Ammonia	G/p	4 oz.	4°C	-	7 days
Sulfide	Pe	2 x 8 oz.	4°C, $Zn(C_2H_3O_2)_2$[3]	-	7 days
ABN's (GC/MS)	G/p	32 oz.	4°C	14 days	40 days[4]
Pesticides/PCB's (GC/ECD)				14 days	40 days[4]
Tributyltin				-	14 days
Total organic carbon				-	14 days
VOA's (GC/MS)	G/s	2 x 4 oz.	4°C	-	7 days
Archival [5]	G/p	32 oz.	(-20)-(-5)°C	-	-
Bioassays	G/p	3 x 64 oz	4 °C	56 days	-
Water					
Metals	P	16 oz.	4°C, HNO_3[6]	-	28 days
Extractable Organics	G/p	16 oz.	4°C	7 days	40 days[1]

[1] pH will be measured in the field using a probe.

[2] All containers are wide-mouth.
G = Glass with screw-top lid
G/p = Glass with PTFE-faced liner in lid
G/s = Glass with PTFE-faced septum liner in lid
Pe = Polyethylene
P = Polypropylene, specially prepared for low-level metals determination
VOA's samples are to be almost entirely filled with sediment with an interstitial water seal at top

[3] Vigorously shake sediment subsample with ~ 5 ml. 2N zinc acetate per 30 g of sediment.

[4] 40 days after extraction

[5] Archived samples that may be analyzed for metals or ABNs, possibly including TBT, may be held for 6-12 months at (-20)-(-5) °C.

Adjust pH to ≤ 2 with 1:1 HNO_3

Table 15. Analytical quality control criteria for precision and recovery in sediments.

Analyte	% Recovery	RPD
Matrix Spikes and Matrix Spike Duplicates (MS/MSD's)		
Conventionals		RPD's from native levels[1]
Total organic carbon	64-125	35
Ammonia	45-145	35
Sulfide	75-125	35
Metals		RPD's from native levels
Antimony	75-125	35
Arsenic	75-125	35
Cadmium	75-125	35
Chromium	75-125	35
Copper	75-125	35
Lead	75-125	35
Mercury	75-125	35
Nickel	75-125	35
Silver	75-125	35
Zinc	75-125	35
Organics (semivolatiles)		RPD's from MS/MSD's
Phenol	26-90	35
2-Chlorophenol	25-102	50
1,4-Dichlorobenzene	28-104	27
N-Nitroso-di-n-propylamine	41-126	38
1,2,4-Trichlorobenzene	38-107	23
4-Chloro-3-methylphenol	26-103	33
Acenaphthene	31-137	19
4-Nitrophenol	11-114	50
2,4-Dinitrotoluene	28-89	47
Pentachlorophenol	17-109	47
Pyrene	35-142	31
Lindane [gamma-BHC]	46-127	50
Heptachlor	35-130	31
Aldrin	34-132	43
Dieldrin	31-134	38
Endrin	42-139	45
p, p'-DDT	23-134	50
Tributyltin	64-125	35
Organics (volatiles)		RPD's from MS/MSD's
1,1-Dichloroethylene	59-172	22
Trichloroethylene	62-137	24
Benzene	66-142	21

Analyte	% Recovery	RPD
Toluene	59-139	21
Chlorobenzene	60-133	21
Surrogate Compounds		
Organics (semivolatiles)	surrogate compounds are analyzed in all samples	
d_5-Nitrobenzene	23-120	-
2-Fluorobiphenyl	30-115	-
d_{14}-Terphenyl	18-137	-
d_5-Phenol	24-113	-
2-Fluorophenol	25-121	-
2,4,6-Tribromophenol	19-122	-
d_4-2-Chlorophenol	20-130	-
d_4-1,2-Dichlorobenzene	20-130	-
Tetrachloro-m-xylene	60-150	-
Decachlorobiphenyl	60-150	-
Organics (volatiles)		
d_8-Toluene	84-138	-
Bromofluorobenzene	59-113	-
d_4-1,2-Dichloroethane	70-121	-

RPD = Relative Percent Difference

[1] Conventional parameters require a triplicate analysis per batch of 20 samples or less, rather than duplicate; with a CV determined, rather than an RPD.

Attachment B

Summary of Sample Analysis
Head of Hylebos Waterway

Event 1A, Event 1B, and Event 1C Data
Hylebos Waterway Pre-Remedial Design Program
for the Commencement Bay / Nearshore Tideflats Superfund Site
Hylebos Waterway Problem Area

From

Technical Memorandum for Event 1A and 1B Data
Striplin Environmental Associates, Inc.
December 19, 1994
and
Round 1 Data Report
Striplin Environmental Associates, Inc.
March 20, 1998

STRIPLIN Environmental Associates

PAUL FUGLEVAND
Dalton, Olmsted & Fuglevand

TECHNICAL MEMORANDUM FOR EVENT 1A AND EVENT 1B DATA - HYLEBOS WATERWAY PRE-REMEDIAL DESIGN PROGRAM

December 19, 1994

Prepared For The Hylebos Cleanup Committee Which Currently Consists Of:

ASARCO, Inc.
Elf Atochem North America, Inc.
General Metals of Tacoma, Inc.
Kaiser Aluminum & Chemical Corporation
Occidental Chemical Corporation
Port of Tacoma

Prepared By:

Striplin Environmental Associates, Inc.
D.M.D., Inc.
Dinnel Marine Research
Dalton, Olmsted & Fuglevand, Inc.

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Table 1. Summary of samples collected during the Event 1A subtidal surface grab sampling program.

Sample			Organic Compounds				Conventionals				
Number	Comments	Metals	ABNs	Pest/PCBs	VOA	TBT	TVS	Grain Size	TOC	Ammonia	Sulfides
1101 S		●	●	●	●		●	●	●	●	●
1102 S		●	●	●	●		●	●	●	●	●
1103 S		●	●	●	●	●	●	●	●	●	●
1104 S		●	●	●	●		●	●	●	●	●
1105 S		●	●	●	●	●	●	●	●	●	●
1106 S		●	●	●	●		●	●	●	●	●
1107 S		●	●	●	●		●	●	●	●	●
1108 S		●	●	●	●	●	●	●	●	●	●
1109 S		●	●	●	●		●	●	●	●	●
1110 S		●	●	●	●		●	●	●	●	●
1111 S		●	●	●	●	●	●	●	●	●	●
1112 S		●	●	●	●		●	●	●	●	●
1113 S		●	●	●	●	●	●	●	●	●	●
1114 S	1101 S split	●	●	●	●		●	●	●	●	●
1115 S	1101 S 01	●	●	●	●	●	●	●	●	●	●
1116 S	1101 S 02	●	●	●	●	●	●	●	●	●	●
2101 S		●	●	●	●	●	●	●	●	●	●
2102 S		●	●	●	●		●	●	●	●	●
2103 S		●	●	●	●	●	●	●	●	●	●
2104 S		●	●	●	●		●	●	●	●	●
2105 S		●	●	●	●		●	●	●	●	●
2106 S		●	●	●	●	●	●	●	●	●	●
2107 S		●	●	●	●		●	●	●	●	●
2108 S		●	●	●	●	●	●	●	●	●	●
2109 S		●	●	●	●		●	●	●	●	●
2110 S		●	●	●	●		●	●	●	●	●
2111 S		●	●	●	●		●	●	●	●	●

Striplin Environmental Associates, Inc.
Technical Memorandum for Events 1A and 1B.
12/19/1994

Table 2. Summary of samples collected during the Event 1A subtidal subsurface coring program.

Sample Number	Comments	Metals	Organic Compounds: ABNs	Organic Compounds: Pest/PCBs	Organic Compounds: VOA	Organic Compounds: TBT	Conventionals: TVS	Conventionals: Grain Size	Conventionals: TOC	Conventionals: Ammonia	Conventionals: Sulfides	Sediment Bioassays
1101A		●	●	●	●		●	●	●	●	●	●
1101 B		●	●	●	●		●	●	●	●	●	●
1102 A		●	●	●	●		●	●	●	●	●	●
1102 B		●	●	●	●		●	●	●	●	●	
1102 C		●	●	●	●		●	●	●	●	●	
1103 A		●	●	●	●	●	●	●	●	●	●	●
1103 B		●	●	●	●	●	●	●	●	●	●	
1104 A		●	●	●	●		●	●	●	●	●	●
1105 A		●	●	●	●	●	●	●	●	●	●	
1105 B		●	●	●	●	●	●	●	●	●	●	
1105 C		●	●	●	●		●	●	●	●	●	
1106 A		●	●	●	●		●	●	●	●	●	●
1106 B		●	●	●	●		●	●	●	●	●	
1107 A		●	●	●	●		●	●	●	●	●	●
1108 A		●	●	●	●	●	●	●	●	●	●	●
1109 A		●	●	●	●		●	●	●	●	●	●
1109 B		●	●	●	●		●	●	●	●	●	●
1110 A		●	●	●	●		●	●	●	●	●	●
1110 B		●	●	●	●		●	●	●	●	●	
1111 A		●	●	●	●	●	●	●	●	●	●	●
1111 B		●	●	●	●	●	●	●	●	●	●	
1112 A		●	●	●	●		●	●	●	●	●	●
1112 B		●	●	●	●		●	●	●	●	●	●
1112 C		●	●	●	●		●	●	●	●	●	
1113 A		●	●	●	●	●	●	●	●	●	●	●
1114 A	1101 A split	●	●	●	●		●	●	●	●	●	
1115 A	1101 A 01	●	●	●	●		●	●	●	●	●	

Table 3. Summary of Samples Collected During the Intertidal Program (Event 1B).

Sample			Organic Compounds				Conventionals				
Number	Comments	Metals	ABNs	Pest/PCBs	VOA	TBT	TVS	Grain Size	TOC	Ammonia	Sulfides
1201 I		●	●	●	●		●	●	●	●	●
1202 I		●	●	●	●		●	●	●	●	●
1203 I		●	●	●	●		●	●	●	●	●
1204 I		●	●	●	●		●	●	●	●	●
1206 I		●	●	●	●		●	●	●	●	●
1207 I		●	●	●	●		●	●	●	●	●
1208 I		●	●	●	●		●	●	●	●	●
1209 I		●	●	●	●		●	●	●	●	●
1210 I		●	●	●	●	●	●	●	●	●	●
1211 I		●	●	●	●	●	●	●	●	●	●
1212 I		●	●	●	●	●	●	●	●	●	●
1213 I		●	●	●	●	●	●	●	●	●	●
1214 I		●	●	●	●		●	●	●	●	●
1215 I		●	●	●	●		●	●	●	●	●
1216 I		●	●	●	●	●	●	●	●	●	●
1217 I		●	●	●	●	●	●	●	●	●	●
1218 I	1201 I split	●	●	●	●		●	●	●	●	●
1219 I	1201 I 01	●	●	●	●		●	●	●	●	●
1220 I	1201 I 02	●	●	●	●		●	●	●	●	●
2201 I	(SM)	●	●	●	●		●	●	●	●	●
2202 I		●	●	●	●		●	●	●	●	●
2203 I	(SM)	●	●	●	●		●		●	●	●
2204 I		●	●	●	●		●	●	●	●	●
2205 I		●	●	●	●		●	●	●	●	●
2206 I		●	●	●	●		●	●	●	●	●
2207 I		●	●	●	●		●	●	●	●	●
2208 I		●	●	●	●	●	●	●	●	●	●
2209 I		●	●	●	●		●	●	●	●	●
2210 I		●	●	●	●		●	●	●	●	●
2211 I		●	●	●	●	●	●	●	●	●	●

Table 3. Summary of Samples Collected During the Intertidal Program (Event 1B).

Sample			Organic Compounds				Conventionals				
Number	Comments	Metals	ABNs	Pest/PCBs	VOA	TBT	TVS	Grain Size	TOC	Ammonia	Sulfides
2212 I		●	●	●	●	●	●	●	●	●	●
2213 I		●	●	●	●		●	●	●	●	●
2214 I		●	●	●	●		●	●	●	●	●
2215 I		●	●	●	●		●	●	●	●	●
3201 I		●	●	●	●		●	●	●	●	●
3202 I	(SM)	●	●	●	●		●	●	●	●	●
3203 I		●	●	●	●		●	●	●	●	●
3204 I		●	●	●	●		●	●	●	●	●
3205 I		●	●	●	●		●	●	●	●	●
3206 I		●	●	●	●		●	●	●	●	●
3207 I		●	●	●	●		●	●	●	●	●
3208 I		●	●	●	●		●	●	●	●	●
3209 I		●	●	●	●	●	●	●	●	●	●
3210 I		●	●	●	●		●	●	●	●	●
3211 I		●	●	●	●		●	●	●	●	●
3212 I		●	●	●	●	●	●	●	●	●	●
3213 I		●	●	●	●		●	●	●	●	●
3214 I		●	●	●	●		●	●	●	●	●
3215 I		●	●	●	●		●	●	●	●	●
3216 I		●	●	●	●		●	●	●	●	●
3217 I		●	●	●	●		●	●	●	●	●
3218 I		●	●	●	●		●	●	●	●	●
3219 I		●	●	●	●		●	●	●	●	●
3220 I		●	●	●	●		●	●	●	●	●
3221 I		●	●	●	●		●	●	●	●	●
3222 I	3201 I split	●	●	●	●		●	●	●	●	●
3223 I	3201 I 01	●	●	●	●		●	●	●	●	●
3224 I	3201 I 02	●	●	●	●		●	●	●	●	●
4201 I		●	●	●	●		●	●	●	●	●
4202 I		●	●	●	●		●	●	●	●	●

Table 2. Summary of samples collected during the Event 1A subtidal subsurface coring program.

Sample			Organic Compounds				Conventionals					Sediment
Number	Comments	Metals	ABNs	Pest/PCBs	VOA	TBT	TVS	Grain Size	TOC	Ammonia	Sulfides	Bioassays
1115 B	1101 B 01	●	●	●	●		●	●	●	●	●	
1116 A	1101 A 02	●	●	●	●		●	●	●	●	●	
1116 B	1101 B 02	●	●	●	●		●	●	●	●	●	
2101 A		●	●	●	●	●	●	●	●	●	●	●
2102 A		●	●	●	●		●	●	●	●	●	●
2102 B		●	●	●	●		●	●	●	●	●	
2103 A		●	●	●	●	●	●	●	●	●	●	●
2104 A		●	●	●	●		●	●	●	●	●	●
2104 B		●	●	●	●		●	●	●	●	●	
2105 A		●	●	●	●		●	●	●	●	●	●
2105 B		●	●	●	●		●	●	●	●	●	
2106 A		●	●	●	●		●	●	●	●	●	●
2107 A		●	●	●	●		●	●	●	●	●	●
2107 B		●	●	●	●		●	●	●	●	●	
2108 A		●	●	●	●		●	●	●	●	●	●
2108 B		●	●	●	●		●	●	●	●	●	
2109 A		●	●	●	●		●	●	●	●	●	●
2109 B		●	●	●	●		●	●	●	●	●	●
2109 C		●	●	●	●		●	●	●	●	●	
2110 A		●	●	●	●		●	●	●	●	●	●
2111 A		●	●	●	●		●	●	●	●	●	●
3101 A		●	●	●	●		●	●	●	●	●	●
3101 B		●	●	●	●		●	●	●	●	●	
3102 A		●	●	●	●		●	●	●	●	●	●
3103 A		●	●	●	●		●	●	●	●	●	●
3103 B		●	●	●	●		●	●	●	●	●	
3104 A		●	●	●	●		●	●	●	●	●	●

PAUL FUGLEVAND
Dalton, Olmsted & Fuglevand

HYLEBOS WATERWAY PRE-REMEDIAL DESIGN PROGRAM

ROUND 1 DATA REPORT

March 20, 1998

Prepared For The Hylebos Cleanup Committee Which Currently Consists Of:

ASARCO, Inc.
Elf Atochem North America, Inc.
General Metals of Tacoma, Inc.
Kaiser Aluminum & Chemical Corporation
Occidental Chemical Corporation
Port of Tacoma

Prepared By:

Striplin Environmental Associates, Inc.
Dalton, Olmsted & Fuglevand, Inc.
Aura Nova Consultants, Inc.
D.M.D., Inc.

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Table 5-4. Event 1C Phase II Samples and Required Analyses.

		Biological Tests			Conventionals						Pest/PCBs			
Field I.D.	Comments	Benthic Infauna	Bioassay[a]	Metals[b]	TVS	Grain Size	TOC	N-Ammonia	Total Sulfides	TBT	Pesticides	PCB Aroclors	VOCs	ABNs[c]
1104 (W)	pw							X	X					
1104 S		X	X		X	X	X	X	X					
1104 S (W2)	pw							X	X					
1115 S	frozen sediment									X				
1117 S				X	X	X	X	X	X	X	X	X	X	X
1118 S				X	X	X	X	X	X	X	X	X	X	X
1119 S				X	X	X	X	X	X	X	X	X	X	X
1120 S				X	X	X	X	X	X	X	X	X	X	X
1121 S				X	X	X	X	X	X	X	X	X	X	X
1122 S				X	X	X	X	X	X	X	X	X	X	X
1123 S				X	X	X	X	X	X	X	X	X	X	X
1124 S				X	X	X	X	X	X	X	X	X	X	X
1125 S				X	X	X	X	X	X	X	X	X	X	X
1126 S				X	X	X	X	X	X	X	X	X	X	X
1127 S					X	X	X	X	X			X		
1128 S	HY-27 bld split			X	X	X	X	X	X		X	X		X
1129 S	HY-27 bld field rep.			X	X	X	X	X	X		X	X		X
1130 S	HY-27 bld field rep.			X	X	X	X	X	X		X	X		X
1131 S	bld SQ-1 (SRM)						X				X	X	X	X
1132 S	bld SQ-1 (SRM)			X			X			X	X	X	X	X
1133 (W)	pw							X	X					
1133 S		X	X	X	X	X	X	X	X	X	X	X	X	X
1133 S (W2)	pw							X	X					
2103 A	frozen sediment									X				
2108 S	frozen sediment									X				
2112 S				X	X	X	X	X	X	X	X	X	X	X
2113 S				X	X	X	X	X	X	X	X	X	X	X
2114 S				X	X	X	X	X	X	X	X	X	X	X
2115 S				X	X	X	X	X	X	X	X	X	X	X
2116 S					X	X	X	X	X			X		
3107 S				X	X	X	X	X	X	X	X	X	X	X
3108 S				X	X	X	X	X	X	X	X	X	X	X

Table 5-6. Event 1C Phase III Samples and Required Analyses.

				Conventionals						
Sample	Bioassay[a]	Benthic	Mercury	TVS	Grain Size	TOC	N-Ammonia	Total Sulfides	Total Solids	Porewater Tri-n-butyl tin
1105S	X			X	X	X	X	X	X	
1117S		X		X	X	X	X	X	X	
1118S										X
1120S										X
1122S										X
1135S		X		X	X	X	X	X	X	
1216I										X
2104S	X	X		X	X	X	X	X	X	
2105S	X			X	X	X	X	X	X	
2112S		X		X	X	X	X	X	X	
2117S[b]				X	X	X	X	X	X	
2118S[c]				X	X	X	X	X	X	
3104S										X
3107S										X
4104S	X			X	X	X	X	X	X	
4116S		X		X	X	X	X	X	X	
5102S	X	X		X	X	X	X	X	X	
5103S	X	X		X	X	X	X	X	X	
5105S	X	X		X	X	X	X	X	X	
5106S	X	X		X	X	X	X	X	X	
5107S	X	X		X	X	X	X	X	X	
5110S	X	X		X	X	X	X	X	X	
5112S	X	X		X	X	X	X	X	X	
5113S	X	X		X	X	X	X	X	X	
5115S	X	X		X	X	X	X	X	X	
5116S	X	X		X	X	X	X	X	X	
5122S[d]				X	X	X	X	X	X	
5123S[e]				X	X	X	X	X	X	
5202I										X
CR1				X	X	X	X	X	X	
CR2				X	X	X	X	X	X	
CR3				X	X	X	X	X	X	
HCC-HY-03			X	X	X	X	X	X	X	X
HCC-HY-14										X
HCC-HY-16		X		X	X	X	X	X	X	
HCC-HY-27		X		X	X	X	X	X	X	
HCC-HY-43[f]			X	X	X	X	X	X	X	

[a] Bioassays included the 10-day amphipod bioassay, the larval echinoderm bioassay, and the 20-day *Neanthes* bioassay.
[b] Blind Split of 2105S
[c] Blind Replicate of 2105S
[d] Blind Split of 5112S
[e] Blind Replicate of 5112S
[f] Blind Split of HCC-HY-03

Table 5-20. Chemical and Biological Results for Hylebos Waterway Pre-Remedial Design and Trustee Stations.

Station	Survey	PCBs ug/kg	# of Chemicals Exceeding SQO	Three Chemicals with the Highest Exceedance Factors (EF)[a]	EF Range for Three Highest Chemicals	Bioassays Amphipod[b]	Larval[b]	Neanthes[b]	Benthic Abundance[b]
1101S	*1A, No Bio Test*	231		No SQO exceedances		Not Tested			Not Tested
1102S	*1A, No Bio Test*	275	1	Arsenic	1.02	Not Tested			Not Tested
1103S	*1A, No Bio Test*	151		No SQO exceedances		Not Tested			Not Tested
1104S	*1C Phase II*	120	13	2,4-DMP, Phenanthrene, Dibenzo(a,h)anth.	3.34U-2.35	MCUL	AOC/SQS	Pass	AOC/SQS
1105S	*1C Phase III*	124	1	Zinc	1.12	Pass	Pass	AOC/SQS	Not tested
1106S	*1A, No Bio Test*	97		No SQO exceedances		Not Tested			Not Tested
1107S	*1A, No Bio Test*	134		No SQO exceedances		Not Tested			Not Tested
1108S	*1A, No Bio Test*	62U		No SQO exceedances		Not Tested			Not Tested
1109S	*1A, No Bio Test*	65		No SQO exceedances		Not Tested			Not Tested
1110S	*1A, No Bio Test*	72		No SQO exceedances		Not Tested			Not Tested
1111S	*1A, No Bio Test*	93U		No SQO exceedances		Not Tested			Not Tested
1112S	*1A, No Bio Test*	97		No SQO exceedances		Not Tested			Not Tested
1113S	*1A, No Bio Test*	36U		No SQO exceedances		Not Tested			Not Tested
1117S	*1C Apr-96*	168	10	Fluoranthene, Chrysene, Pyrene	3.64-2.33	Pass	Pass	Pass	AOC/SQS
1118S	*1C, No Bio Test*	44		No SQO exceedances		Not Tested			Not Tested
1119S	*1C, No Bio Test*	48		No SQO exceedances		Not Tested			Not Tested
1120S	*1C Apr-96*	132	4	Benzofluors., BAP, Chrysene	1.28-1.11	Pass	AOC/SQS	Pass	Not tested
1121S	*1C, No Bio Test*	53		No SQO exceedances		Not Tested			Not Tested
1122S	*1C Apr-96*	150	1	Arsenic	1.05	Pass	Pass	Pass	Not tested
1123S	*1C, No Bio Test*	39U		No SQO exceedances		Not Tested			Not Tested
1124S	*1C, No Bio Test*	76		No SQO exceedances		Not Tested			Not Tested
1125S	*1C, No Bio Test*	149		No SQO exceedances		Not Tested			Not Tested
1126S	*1C, No Bio Test*	100		No SQO exceedances		Not Tested			Not Tested
1127S	*1C, No Bio Test*	128		PCBs analyzed only		Not Tested			Not Tested
1133S	*1C Phase II*	156		No SQO exceedances		Pass	MCUL	Pass	Pass
1134S	*1C, No Bio Test*	41		No SQO exceedances		Not Tested			Not Tested
1135S	*1C Apr-96*	39UM	1	4,4'-DDE	1.83	Pass	Pass	Pass	AOC/SQS
1201I	*1C Apr-96*	144M	14	Benzofluors., N-Nitro., Dibenzo(a,h)anthracene	3.55-3.27	Pass	MCUL	Pass	Not tested
1202I	*1B, No Bio Test*	27U		No SQO exceedances		Not Tested			Not Tested
1203I	*1C Apr-96*	77	10	Benzo(a)anthracene, Fluorene, Anthracene	2.31-1.67	Pass	Pass	Pass	Not tested
1204I	*1B, No Bio Test*	25U		No SQO exceedances		Not Tested			Not Tested
1206I	*1B, No Bio Test*	30U		No SQO exceedances		Not Tested			Not Tested
1207I	*1B, No Bio Test*	33U		No SQO exceedances		Not Tested			Not Tested
1208I	*1C Apr-96*	47U	3	Arsenic, N-nitro., 2,4-DMP	2.35 - 1.62U	Pass	Pass	Pass	Not tested
1209I	*1B, No Bio Test*	30U		No SQO exceedances		Not Tested			Not Tested
1210I	*1C Apr-96*	28	1	DMP	2.25	Pass	Pass	Pass	Not tested
1211I	*1B, No Bio Test*	30U		No SQO exceedances		Not Tested			Not Tested

Table 5-20. Chemical and Biological Results for Hylebos Waterway Pre-Remedial Design and Trustee Stations.

Station	Survey	PCBs ug/kg	# of Chemicals Exceeding SQO	Three Chemicals with the Highest Exceedance Factors (EF)[a]	EF Range for Three Highest Chemicals	Bioassays			Benthic Abundance[b]
						Amphipod[b]	Larval[b]	Neanthes[b]	
12121	*1C Apr-96*	100	2	DMP, Copper	2.94-2.36	MCUL	MCUL	MCUL	Not tested
12131	*1C Apr-96*	31U	1	Arsenic	3.37	Pass	AOC/SQS	Pass	Not tested
12141	*1B, No Bio Test*	27U		No SQO exceedances		Not Tested			Not Tested
12151	*1B, No Bio Test*	25U		No SQO exceedances		Not Tested			Not Tested
12161	*1C Apr-96*	28U	5	Zinc, Arsenic, Copper	4.61-2.43	Pass	AOC/SQS	Pass	Not tested
12171	*1C Apr-96*	25U	5	Arsenic, Zinc, Copper	4.58-2.39	Pass	MCUL	Pass	Not tested
2101S	*1A, No Bio Test*	249		No SQO exceedances		Not Tested			Not Tested
2102S	*1A, No Bio Test*	580	1	Arsenic	1.02	Not Tested			Not Tested
2103S	*1A, No Bio Test*	373	2	4,4'-DDE, Mercury	1.02-1.02	Not Tested			Not Tested
2104S	*1C Phase III*	380	3	4,4'-DDT, Mercury, 4,4'-DDE	1.32-1.11	Pass	Pass	AOC/SQS	MCUL
2105S	*1C Phase III*	370	1	Mercury	1.25	Pass	Pass	Pass	Not tested
2106S	*1A, No Bio Test*	350		No SQO exceedances		Not Tested			Not Tested
2107S	*1A, No Bio Test*	551	4	4,4'-DDT, Mercury, Arsenic	1.5-1.08	Not Tested			Not Tested
2108S	*1A, No Bio Test*	404		No SQO exceedances		Not Tested			Not Tested
2109S	*1A, No Bio Test*	243		No SQO exceedances		Not Tested			Not Tested
2110S	*1A, No Bio Test*	223		No SQO exceedances		Not Tested			Not Tested
2111S	*1A, No Bio Test*	450		No SQO exceedances		Not Tested			Not Tested
2112S	*1C Apr-96*	430	2	Zinc, Arsenic	2.78-2.35	Pass	Pass	Pass	AOC/SQS
2113S	*1C Apr-96*	1700	3	4,4'-DDT, 4,4'-DDD, Arsenic	12.65-2.47	AOC/SQS	Pass	Pass	Not tested
2114S	*1C Apr-96*	630	23	Arsenic, 4,4'-DDT, Dibenzo(ah)anthracene	13.84-5.22	AOC/SQS	Pass	Pass	Not tested
2115S	*1C, No Bio Test*	390	1	Zinc	1.49	Not Tested			Not Tested
2116S	*1C, No Bio Test*	320		PCBs analyzed only		Not Tested			Not Tested
2201SM	*Source Material*	21U	5	Zinc, Arsenic, Antimony	34.15-10.27	Not Tested			Not Tested
22021	*1C Apr-96*	110J	13	Zinc, Arsenic, Antimony	22.63-4.78	Pass	MCUL	Pass	Not tested
2203SM	*Source Material*	2800U	10	4,4'-DDT, 4,4'-DDE, HCB	22.06-6.36	Not Tested			Not Tested
22041	*1B, No Bio Test*	168		No SQO exceedances		Not Tested			Not Tested
22051	*1B, No Bio Test*	530J	3	Arsenic, N-nitro., 2,4-DMP	2.4-1.03U	Not Tested			Not Tested
22061	*1B, No Bio Test*	600J	12	4,4'-DDD, 4,4'-DDT, 4,4'-DDE	13.7-10.22	Not Tested			Not Tested
22071	*1B, No Bio Test*	26U		No SQO exceedances		Not Tested			Not Tested
22081	*1C Apr-96*	28U	1	Arsenic	1.19	Pass	Pass	Pass	Not tested
22091	*1C Apr-96*	45	1	Arsenic	1.96	Pass	AOC/SQS	Pass	Not tested
22101	*1B, No Bio Test*	179		No SQO exceedances		Not Tested			Not Tested
22111	*1B, No Bio Test*	1680	18	Anthracene, Fluoranthene, Benzo(a)anthracene	8.33-5	Not Tested			Not Tested
22121	*1C Apr-96*	352	2	Arsenic, N-nitrosodiphenylamine	1.5-1.07	Pass	Pass	Pass	Not tested
22131	*1B, No Bio Test*	23		No SQO exceedances		Not Tested			Not Tested
22141	*1B, No Bio Test*	188		No SQO exceedances		Not Tested			Not Tested
22151	*1B, No Bio Test*	221		No SQO exceedances		Not Tested			Not Tested

PAUL FUGLEVAND
Dalton, Olmsted & Fuglevand

TECHNICAL MEMORANDUM FOR EVENT 1A AND EVENT 1B DATA - HYLEBOS WATERWAY PRE-REMEDIAL DESIGN PROGRAM

December 19, 1994

Prepared For The Hylebos Cleanup Committee Which Currently Consists Of:

ASARCO, Inc.
Elf Atochem North America, Inc.
General Metals of Tacoma, Inc.
Kaiser Aluminum & Chemical Corporation
Occidental Chemical Corporation
Port of Tacoma

Prepared By:

Striplin Environmental Associates, Inc.
D.M.D., Inc.
Dinnel Marine Research
Dalton, Olmsted & Fuglevand, Inc.

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Striplin Environmental Associates, Inc.
Technical Memorandum for Events 1A and 1B.
12/19/1994

Table 1. *Summary of samples collected during the Event 1A subtidal surface grab sampling program.*

Sample			Organic Compounds				Conventionals				
Number	Comments	Metals	ABNs	Pest/PCBs	VOA	TBT	TVS	Grain Size	TOC	Ammonia	Sulfides
1101 S		●	●	●	●		●	●	●	●	●
1102 S		●	●	●	●		●	●	●	●	●
1103 S		●	●	●	●	●	●	●	●	●	●
1104 S		●	●	●	●		●	●	●	●	●
1105 S		●	●	●	●	●	●	●	●	●	●
1106 S		●	●	●	●		●	●	●	●	●
1107 S		●	●	●	●		●	●	●	●	●
1108 S		●	●	●	●	●	●	●	●	●	●
1109 S		●	●	●	●		●	●	●	●	●
1110 S		●	●	●	●		●	●	●	●	●
1111 S		●	●	●	●	●	●	●	●	●	●
1112 S		●	●	●	●		●	●	●	●	●
1113 S		●	●	●	●	●	●	●	●	●	●
1114 S	1101 S split	●	●	●	●		●	●	●	●	●
1115 S	1101 S 01	●	●	●	●	●	●	●	●	●	●
1116 S	1101 S 02	●	●	●	●	●	●	●	●	●	●
2101 S		●	●	●	●	●	●	●	●	●	●
2102 S		●	●	●	●		●	●	●	●	●
2103 S		●	●	●	●	●	●	●	●	●	●
2104 S		●	●	●	●		●	●	●	●	●
2105 S		●	●	●	●		●	●	●	●	●
2106 S		●	●	●	●	●	●	●	●	●	●
2107 S		●	●	●	●		●	●	●	●	●
2108 S		●	●	●	●	●	●	●	●	●	●
2109 S		●	●	●	●		●	●	●	●	●
2110 S		●	●	●	●		●	●	●	●	●
2111 S		●	●	●	●		●	●	●	●	●

Striplin Environmental Associates, Inc.
Technical Memorandum for Events 1A and 1B.
12/19/1994

Table 2. Summary of samples collected during the Event 1A subtidal subsurface coring program.

Sample			Organic Compounds				Conventionals					Sediment
Number	Comments	Metals	ABNs	Pest/PCBs	VOA	TBT	TVS	Grain Size	TOC	Ammonia	Sulfides	Bioassays
1101A		●	●	●	●		●	●	●	●	●	●
1101 B		●	●	●	●		●	●	●	●	●	●
1102 A		●	●	●	●		●	●	●	●	●	●
1102 B		●	●	●	●		●	●	●	●	●	
1102 C		●	●	●	●		●	●	●	●	●	
1103 A		●	●	●	●	●	●	●	●	●	●	●
1103 B		●	●	●	●	●	●	●	●	●	●	
1104 A		●	●	●	●		●	●	●	●	●	●
1105 A		●	●	●	●	●	●	●	●	●	●	
1105 B		●	●	●	●	●	●	●	●	●	●	
1105 C		●	●	●	●		●	●	●	●	●	
1106 A		●	●	●	●		●	●	●	●	●	●
1106 B		●	●	●	●		●	●	●	●	●	
1107 A		●	●	●	●		●	●	●	●	●	●
1108 A		●	●	●	●	●	●	●	●	●	●	●
1109 A		●	●	●	●		●	●	●	●	●	●
1109 B		●	●	●	●		●	●	●	●	●	●
1110 A		●	●	●	●		●	●	●	●	●	●
1110 B		●	●	●	●		●	●	●	●	●	
1111 A		●	●	●	●	●	●	●	●	●	●	●
1111 B		●	●	●	●	●	●	●	●	●	●	
1112 A		●	●	●	●		●	●	●	●	●	●
1112 B		●	●	●	●		●	●	●	●	●	●
1112 C		●	●	●	●		●	●	●	●	●	
1113 A		●	●	●	●	●	●	●	●	●	●	●
1114 A	1101 A split	●	●	●	●		●	●	●	●	●	
1115 A	1101 A 01	●	●	●	●		●	●	●	●	●	

Table 2. Summary of samples collected during the Event 1A subtidal subsurface coring program.

Sample			Organic Compounds				Conventionals					Sediment
Number	Comments	Metals	ABNs	Pest/PCBs	VOA	TBT	TVS	Grain Size	TOC	Ammonia	Sulfides	Bioassays
1115 B	1101 B 01	●	●	●	●		●	●	●	●	●	
1116 A	1101 A 02	●	●	●	●		●	●	●	●	●	
1116 B	1101 B 02	●	●	●	●		●	●	●	●	●	
2101 A		●	●	●	●	●	●	●	●	●	●	●
2102 A		●	●	●	●		●	●	●	●	●	●
2102 B		●	●	●	●		●	●	●	●	●	
2103 A		●	●	●	●	●	●	●	●	●	●	●
2104 A		●	●	●	●		●	●	●	●	●	●
2104 B		●	●	●	●		●	●	●	●	●	
2105 A		●	●	●	●		●	●	●	●	●	●
2105 B		●	●	●	●		●	●	●	●	●	
2106 A		●	●	●	●		●	●	●	●	●	●
2107 A		●	●	●	●		●	●	●	●	●	●
2107 B		●	●	●	●		●	●	●	●	●	
2108 A		●	●	●	●		●	●	●	●	●	●
2108 B		●	●	●	●		●	●	●	●	●	
2109 A		●	●	●	●		●	●	●	●	●	●
2109 B		●	●	●	●		●	●	●	●	●	●
2109 C		●	●	●	●		●	●	●	●	●	
2110 A		●	●	●	●		●	●	●	●	●	●
2111 A		●	●	●	●		●	●	●	●	●	●
3101 A		●	●	●	●		●	●	●	●	●	●
3101 B		●	●	●	●		●	●	●	●	●	
3102 A		●	●	●	●		●	●	●	●	●	●
3103 A		●	●	●	●		●	●	●	●	●	●
3103 B		●	●	●	●		●	●	●	●	●	
3104 A		●	●	●	●		●	●	●	●	●	●

Table 3. Summary of Samples Collected During the Intertidal Program (Event 1B).

Sample			Organic Compounds				Conventionals				
Number	Comments	Metals	ABNs	Pest/PCBs	VOA	TBT	TVS	Grain Size	TOC	Ammonia	Sulfides
1201 I		●	●	●	●		●	●	●	●	●
1202 I		●	●	●	●		●	●	●	●	●
1203 I		●	●	●	●		●	●	●	●	●
1204 I		●	●	●	●		●	●	●	●	●
1206 I		●	●	●	●		●	●	●	●	●
1207 I		●	●	●	●		●	●	●	●	●
1208 I		●	●	●	●		●	●	●	●	●
1209 I		●	●	●	●		●	●	●	●	●
1210 I		●	●	●	●	●	●	●	●	●	●
1211 I		●	●	●	●	●	●	●	●	●	●
1212 I		●	●	●	●	●	●	●	●	●	●
1213 I		●	●	●	●	●	●	●	●	●	●
1214 I		●	●	●	●		●	●	●	●	●
1215 I		●	●	●	●		●	●	●	●	●
1216 I		●	●	●	●	●	●	●	●	●	●
1217 I		●	●	●	●	●	●	●	●	●	●
1218 I	1201 I split	●	●	●	●		●	●	●	●	●
1219 I	1201 I 01	●	●	●	●		●	●	●	●	●
1220 I	1201 I 02	●	●	●	●		●	●	●	●	●
2201 I	(SM)	●	●	●	●		●	●	●	●	●
2202 I		●	●	●	●		●	●	●	●	●
2203 I	(SM)	●	●	●	●		●		●	●	●
2204 I		●	●	●	●		●	●	●	●	●
2205 I		●	●	●	●		●	●	●	●	●
2206 I		●	●	●	●		●	●	●	●	●
2207 I		●	●	●	●		●	●	●	●	●
2208 I		●	●	●	●	●	●	●	●	●	●
2209 I		●	●	●	●		●	●	●	●	●
2210 I		●	●	●	●		●	●	●	●	●
2211 I		●	●	●	●	●	●	●	●	●	●

Table 3. *Summary of Samples Collected During the Intertidal Program (Event 1B).*

Sample			Organic Compounds				Conventionals				
Number	Comments	Metals	ABNs	Pest/PCBs	VOA	TBT	TVS	Grain Size	TOC	Ammonia	Sulfides
2212 I		●	●	●	●	●	●	●	●	●	●
2213 I		●	●	●	●		●	●	●	●	●
2214 I		●	●	●	●		●	●	●	●	●
2215 I		●	●	●	●		●	●	●	●	●
3201 I		●	●	●	●		●	●	●	●	●
3202 I	(SM)	●	●	●	●		●	●	●	●	●
3203 I		●	●	●	●		●	●	●	●	●
3204 I		●	●	●	●		●	●	●	●	●
3205 I		●	●	●	●		●	●	●	●	●
3206 I		●	●	●	●		●	●	●	●	●
3207 I		●	●	●	●		●	●	●	●	●
3208 I		●	●	●	●		●	●	●	●	●
3209 I		●	●	●	●	●	●	●	●	●	●
3210 I		●	●	●	●		●	●	●	●	●
3211 I		●	●	●	●		●	●	●	●	●
3212 I		●	●	●	●	●	●	●	●	●	●
3213 I		●	●	●	●		●	●	●	●	●
3214 I		●	●	●	●		●	●	●	●	●
3215 I		●	●	●	●		●	●	●	●	●
3216 I		●	●	●	●		●	●	●	●	●
3217 I		●	●	●	●		●	●	●	●	●
3218 I		●	●	●	●		●	●	●	●	●
3219 I		●	●	●	●		●	●	●	●	●
3220 I		●	●	●	●		●	●	●	●	●
3221 I		●	●	●	●		●	●	●	●	●
3222 I	3201 I split	●	●	●	●		●	●	●	●	●
3223 I	3201 I 01	●	●	●	●		●	●	●	●	●
3224 I	3201 I 02	●	●	●	●		●	●	●	●	●
4201 I		●	●	●	●		●	●	●	●	●
4202 I		●	●	●	●		●	●	●	●	●

STRIPLIN Environmental Associates

PAUL FUGLEVAND
Dalton, Olmsted & Fuglevand

HYLEBOS WATERWAY PRE-REMEDIAL DESIGN PROGRAM

ROUND 1 DATA REPORT

March 20, 1998

Prepared For The Hylebos Cleanup Committee Which Currently Consists Of:

ASARCO, Inc.
Elf Atochem North America, Inc.
General Metals of Tacoma, Inc.
Kaiser Aluminum & Chemical Corporation
Occidental Chemical Corporation
Port of Tacoma

Prepared By:

Striplin Environmental Associates, Inc.
Dalton, Olmsted & Fuglevand, Inc.
Aura Nova Consultants, Inc.
D.M.D., Inc.

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Table 5-4. Event 1C Phase II Samples and Required Analyses.

		Biological Tests			Conventionals						Pest/PCBs			
Field I.D.	Comments	Benthic Infauna	Bioassay[a]	Metals[b]	TVS	Grain Size	TOC	N-Ammonia	Total Sulfides	TBT	Pesticides	PCB Aroclors	VOCs	ABNs[c]
1104 (W)	pw							X	X					
1104 S		X	X		X	X	X	X	X					
1104 S (W2)	pw							X	X					
1115 S	frozen sediment									X				
1117 S				X	X	X	X	X	X	X	X	X	X	X
1118 S				X	X	X	X	X	X	X	X	X	X	X
1119 S				X	X	X	X	X	X	X	X	X	X	X
1120 S				X	X	X	X	X	X	X	X	X	X	X
1121 S				X	X	X	X	X	X	X	X	X	X	X
1122 S				X	X	X	X	X	X	X	X	X	X	X
1123 S				X	X	X	X	X	X	X	X	X	X	X
1124 S				X	X	X	X	X	X	X	X	X	X	X
1125 S				X	X	X	X	X	X	X	X	X	X	X
1126 S				X	X	X	X	X	X	X	X	X	X	X
1127 S					X	X	X	X	X			X		
1128 S	HY-27 bld split			X	X	X	X	X	X		X	X		X
1129 S	HY-27 bld field rep.			X	X	X	X	X	X		X	X		X
1130 S	HY-27 bld field rep.			X	X	X	X	X	X		X	X		X
1131 S	bld SQ-1 (SRM)						X				X	X	X	X
1132 S	bld SQ-1 (SRM)			X			X			X	X	X	X	X
1133 (W)	pw							X	X					
1133 S		X	X	X	X	X	X	X	X	X	X	X	X	X
1133 S (W2)	pw							X	X					
2103 A	frozen sediment									X				
2108 S	frozen sediment									X				
2112 S				X	X	X	X	X	X	X	X	X	X	X
2113 S				X	X	X	X	X	X	X	X	X	X	X
2114 S				X	X	X	X	X	X	X	X	X	X	X
2115 S				X	X	X	X	X	X	X	X	X	X	X
2116 S					X	X	X	X	X			X		
3107 S				X	X	X	X	X	X	X	X	X	X	X
3108 S				X	X	X	X	X	X	X	X	X	X	X

Table 5-6. Event 1C Phase III Samples and Required Analyses.

Sample	Bioassay[a]	Benthic	Mercury	Conventionals: TVS	Conventionals: Grain Size	Conventionals: TOC	Conventionals: N-Ammonia	Conventionals: Total Sulfides	Conventionals: Total Solids	Porewater Tri-n-butyl tin
1105S	X			X	X	X	X	X	X	
1117S		X		X	X	X	X	X	X	
1118S										X
1120S										X
1122S										X
1135S		X		X	X	X	X	X	X	
1216I										X
2104S	X	X		X	X	X	X	X	X	
2105S	X			X	X	X	X	X	X	
2112S		X		X	X	X	X	X	X	
2117S[b]				X	X	X	X	X	X	
2118S[c]				X	X	X	X	X	X	
3104S										X
3107S										X
4104S	X			X	X	X	X	X	X	
4116S		X		X	X	X	X	X	X	
5102S	X	X		X	X	X	X	X	X	
5103S	X	X		X	X	X	X	X	X	
5105S	X	X		X	X	X	X	X	X	
5106S	X	X		X	X	X	X	X	X	
5107S	X	X		X	X	X	X	X	X	
5110S	X	X		X	X	X	X	X	X	
5112S	X	X		X	X	X	X	X	X	
5113S	X	X		X	X	X	X	X	X	
5115S	X	X		X	X	X	X	X	X	
5116S	X	X		X	X	X	X	X	X	
5122S[d]				X	X	X	X	X	X	
5123S[e]				X	X	X	X	X	X	
5202I										X
CR1				X	X	X	X	X	X	
CR2				X	X	X	X	X	X	
CR3				X	X	X	X	X	X	
HCC-HY-03			X	X	X	X	X	X	X	X
HCC-HY-14										X
HCC-HY-16		X		X	X	X	X	X	X	
HCC-HY-27		X		X	X	X	X	X	X	
HCC-HY-43[f]			X	X	X	X	X	X	X	

[a] Bioassays included the 10-day amphipod bioassay, the larval echinoderm bioassay, and the 20-day *Neanthes* bioassay.
[b] Blind Split of 2105S
[c] Blind Replicate of 2105S
[d] Blind Split of 5112S
[e] Blind Replicate of 5112S
[f] Blind Split of HCC-HY-03

Table 5-20. Chemical and Biological Results for Hylebos Waterway Pre-Remedial Design and Trustee Stations.

Station	Survey	PCBs ug/kg	# of Chemicals Exceeding SQO	Three Chemicals with the Highest Exceedance Factors (EF)[a]	EF Range for Three Highest Chemicals	Bioassays			Benthic Abundance[b]
						Amphipod[b]	Larval[b]	Neanthes[b]	
1101S	*1A, No Bio Test*	231		No SQO exceedances		Not Tested			Not Tested
1102S	*1A, No Bio Test*	275	1	Arsenic	1.02	Not Tested			Not Tested
1103S	*1A, No Bio Test*	151		No SQO exceedances		Not Tested			Not Tested
1104S	*1C Phase II*	120	13	2,4-DMP, Phenanthrene, Dibenzo(a,h)anth.	3.34U-2.35	MCUL	AOC/SQS	Pass	AOC/SQS
1105S	*1C Phase III*	124	1	Zinc	1.12	Pass	Pass	AOC/SQS	Not tested
1106S	*1A, No Bio Test*	97		No SQO exceedances		Not Tested			Not Tested
1107S	*1A, No Bio Test*	134		No SQO exceedances		Not Tested			Not Tested
1108S	*1A, No Bio Test*	62U		No SQO exceedances		Not Tested			Not Tested
1109S	*1A, No Bio Test*	65		No SQO exceedances		Not Tested			Not Tested
1110S	*1A, No Bio Test*	72		No SQO exceedances		Not Tested			Not Tested
1111S	*1A, No Bio Test*	93U		No SQO exceedances		Not Tested			Not Tested
1112S	*1A, No Bio Test*	97		No SQO exceedances		Not Tested			Not Tested
1113S	*1A, No Bio Test*	36U		No SQO exceedances		Not Tested			Not Tested
1117S	*1C Apr-96*	168	10	Fluoranthene, Chrysene, Pyrene	3.64-2.33	Pass	Pass	Pass	AOC/SQS
1118S	*1C, No Bio Test*	44		No SQO exceedances		Not Tested			Not Tested
1119S	*1C, No Bio Test*	48		No SQO exceedances		Not Tested			Not Tested
1120S	*1C Apr-96*	132	4	Benzofluors., BAP, Chrysene	1.28-1.11	Pass	AOC/SQS	Pass	Not tested
1121S	*1C, No Bio Test*	53		No SQO exceedances		Not Tested			Not Tested
1122S	*1C Apr-96*	150	1	Arsenic	1.05	Pass	Pass	Pass	Not tested
1123S	*1C, No Bio Test*	39U		No SQO exceedances		Not Tested			Not Tested
1124S	*1C, No Bio Test*	76		No SQO exceedances		Not Tested			Not Tested
1125S	*1C, No Bio Test*	149		No SQO exceedances		Not Tested			Not Tested
1126S	*1C, No Bio Test*	100		No SQO exceedances		Not Tested			Not Tested
1127S	*1C, No Bio Test*	128		PCBs analyzed only		Not Tested			Not Tested
1133S	*1C Phase II*	156		No SQO exceedances		Pass	MCUL	Pass	Pass
1134S	*1C, No Bio Test*	41		No SQO exceedances		Not Tested			Not Tested
1135S	*1C Apr-96*	39UM	1	4,4'-DDE	1.83	Pass	Pass	Pass	AOC/SQS
1201I	*1C Apr-96*	144M	14	Benzofluors., N-Nitro., Dibenzo(a,h)anthracene	3.55-3.27	Pass	MCUL	Pass	Not tested
1202I	*1B, No Bio Test*	27U		No SQO exceedances		Not Tested			Not Tested
1203I	*1C Apr-96*	77	10	Benzo(a)anthracene, Fluorene, Anthracene	2.31-1.67	Pass	Pass	Pass	Not tested
1204I	*1B, No Bio Test*	25U		No SQO exceedances		Not Tested			Not Tested
1206I	*1B, No Bio Test*	30U		No SQO exceedances		Not Tested			Not Tested
1207I	*1B, No Bio Test*	33U		No SQO exceedances		Not Tested			Not Tested
1208I	*1C Apr-96*	47U	3	Arsenic, N-nitro., 2,4-DMP	2.35 - 1.62U	Pass	Pass	Pass	Not tested
1209I	*1B, No Bio Test*	30U		No SQO exceedances		Not Tested			Not Tested
1210I	*1C Apr-96*	28	1	DMP	2.25	Pass	Pass	Pass	Not tested
1211I	*1B, No Bio Test*	30U		No SQO exceedances		Not Tested			Not Tested

Table 5-20. Chemical and Biological Results for Hylebos Waterway Pre-Remedial Design and Trustee Stations.

Station	Survey	PCBs ug/kg	# of Chemicals Exceeding SQO	Three Chemicals with the Highest Exceedance Factors (EF)[a]	EF Range for Three Highest Chemicals	Bioassays Amphipod[b]	Larval[b]	Neanthes[b]	Benthic Abundance[b]
1212I	*IC Apr-96*	100	2	DMP, Copper	2.94-2.36	MCUL	MCUL	MCUL	Not tested
1213I	*IC Apr-96*	31U	1	Arsenic	3.37	Pass	AOC/SQS	Pass	Not tested
1214I	*IB, No Bio Test*	27U		No SQO exceedances		Not Tested			Not Tested
1215I	*IB, No Bio Test*	25U		No SQO exceedances		Not Tested			Not Tested
1216I	*IC Apr-96*	28U	5	Zinc, Arsenic, Copper	4.61-2.43	Pass	AOC/SQS	Pass	Not tested
1217I	*IC Apr-96*	25U	5	Arsenic, Zinc, Copper	4.58-2.39	Pass	MCUL	Pass	Not tested
2101S	*IA, No Bio Test*	249		No SQO exceedances		Not Tested			Not Tested
2102S	*IA, No Bio Test*	580	1	Arsenic	1.02	Not Tested			Not Tested
2103S	*IA, No Bio Test*	373	2	4,4'-DDE, Mercury	1.02-1.02	Not Tested			Not Tested
2104S	*IC Phase III*	380	3	4,4'-DDT, Mercury, 4,4'-DDE	1.32-1.11	Pass	Pass	AOC/SQS	MCUL
2105S	*IC Phase III*	370	1	Mercury	1.25	Pass	Pass	Pass	Not tested
2106S	*IA, No Bio Test*	350		No SQO exceedances		Not Tested			Not Tested
2107S	*IA, No Bio Test*	551	4	4,4'-DDT, Mercury, Arsenic	1.5-1.08	Not Tested			Not Tested
2108S	*IA, No Bio Test*	404		No SQO exceedances		Not Tested			Not Tested
2109S	*IA, No Bio Test*	243		No SQO exceedances		Not Tested			Not Tested
2110S	*IA, No Bio Test*	223		No SQO exceedances		Not Tested			Not Tested
2111S	*IA, No Bio Test*	450		No SQO exceedances		Not Tested			Not Tested
2112S	*IC Apr-96*	430	2	Zinc, Arsenic	2.78-2.35	Pass	Pass	Pass	AOC/SQS
2113S	*IC Apr-96*	1700	3	4,4'-DDT, 4,4'-DDD, Arsenic	12.65-2.47	AOC/SQS	Pass	Pass	Not tested
2114S	*IC Apr-96*	630	23	Arsenic, 4,4'-DDT, Dibenzo(ah)anthracene	13.84-5.22	AOC/SQS	Pass	Pass	Not tested
2115S	*IC, No Bio Test*	390	1	Zinc	1.49	Not Tested			Not Tested
2116S	*IC, No Bio Test*	320		PCBs analyzed only		Not Tested			Not Tested
2201SM	*Source Material*	21U	5	Zinc, Arsenic, Antimony	34.15-10.27	Not Tested			Not Tested
2202I	*IC Apr-96*	110J	13	Zinc, Arsenic, Antimony	22.63-4.78	Pass	MCUL	Pass	Not tested
2203SM	*Source Material*	2800U	10	4,4'-DDT, 4,4'-DDE, HCB	22.06-6.36	Not Tested			Not Tested
2204I	*IB, No Bio Test*	168		No SQO exceedances		Not Tested			Not Tested
2205I	*IB, No Bio Test*	530J	3	Arsenic, N-nitro., 2,4-DMP	2.4-1.03U	Not Tested			Not Tested
2206I	*IB, No Bio Test*	600J	12	4,4'-DDD, 4,4'-DDT, 4,4'-DDE	13.7-10.22	Not Tested			Not Tested
2207I	*IB, No Bio Test*	26U		No SQO exceedances		Not Tested			Not Tested
2208I	*IC Apr-96*	28U	1	Arsenic	1.19	Pass	Pass	Pass	Not tested
2209I	*IC Apr-96*	45	1	Arsenic	1.96	Pass	AOC/SQS	Pass	Not tested
2210I	*IB, No Bio Test*	179		No SQO exceedances		Not Tested			Not Tested
2211I	*IB, No Bio Test*	1680	18	Anthracene, Fluoranthene, Benzo(a)anthracene	8.33-5	Not Tested			Not Tested
2212I	*IC Apr-96*	352	2	Arsenic, N-nitrosodiphenylamine	1.5-1.07	Pass	Pass	Pass	Not tested
2213I	*IB, No Bio Test*	23		No SQO exceedances		Not Tested			Not Tested
2214I	*IB, No Bio Test*	188		No SQO exceedances		Not Tested			Not Tested
2216I	*IB, No Bio Test*	221		No SQO exceedances		Not Tested			Not Tested

D - 2003 ESA

Appendix D
2003 ESA Consultation Road Map

Grette Associates LLC
ENVIRONMENTAL CONSULTANTS

March 21, 2003
Revised April 14, 2003

Mr. Peter Contreras, HW-113
U.S. Environmental Protection Agency
Region 10 (ECL-111)
1200 Sixth Avenue
Seattle, Washington 98101

RE: Head of the Hylebos Waterway Problem Area
ESA Consultation Documentation Draft "Road Map"

Dear Mr. Contreras:

This ESA Road Map is presented on behalf of the Head of the Hylebos Cleanup Group (HHCG) (consisting of ATOFINA Chemicals, Inc. [ATOFINA] and General Metals of Tacoma, Inc. [General Metals]). The HHCG has proposed remedial actions and bank cleanup for the Head of the Hylebos Waterway Problem Area. In order to expedite the initiation of these activities, they have been divided into discrete actions that will occur in, 1) the 2003 construction season (late spring 2003 through early 2004), and 2) the 2004 construction season (summer 2004 through early 2005). The HHCG is suggesting this division of work as a means to expedite approvals and ensure that construction activities can be implemented during the 2003 construction season. Implementation of specific Project elements during the 2003 construction season will increase the likelihood that all remedial dredging activities can be completed within the 2004 construction season.

Actions proposed for the 2003 construction season entail land-based work on the shoreline, in-water demolition and relocation of a portion of the Hylebos Marina. The potential effects of these types of actions are believed to be appropriate for evaluation through informal consultation pursuant to the Endangered Species Act (ESA). This letter constitutes an addendum, in "road map" format, to the previously approved Biological Assessment (BA) for the Commencement Bay Nearshore/Tideflats Superfund Site (EPA 2000a) (referred to hereafter as the Commencement Bay BA). This road map references existing ESA documentation that addresses the Head of the Hylebos Waterway Problem Area, and supplements it with Project-specific information.

The actions addressed by this road map will result in net benefits to littoral habitat through removal of sediments exceeding Sediment Quality Objectives (SQOs), old construction debris, creosote-treated timber bulkheads and dilapidated structures, and by increasing the acreage of aquatic habitat (specifically littoral habitat) through conversion of upland (1.9 acres). Additional benefits to the littoral habitat will be provided through a decrease in the amount of littoral habitat shaded by structures. A portion of these benefits to littoral habitat resulting from the Project will be offset by impacts to habitat that will occur during the 2004 construction season; however, the final Post-Project condition in 2005 will result in a net increase of 1.9 acres of aquatic habitat (including a 0.1 acre increase of littoral habitat) and a 0.16-acre reduction in shading of littoral habitat. Therefore, in total the HHCG's remediation actions at the head of Hylebos Waterway will result in a net gain in acreage and function of aquatic habitat. The Project will improve the baseline condition of the habitat within the Project Area. The owners of the property recognize that this new condition establishes the baseline for impact analysis for any action that may alter the habitat in the future.

The actions proposed for the 2004 construction season involve continued relocation of the Hylebos Marina, dredging and other water-based activities. The potential effects of these actions are addressed in a separate addendum to the Commencement Bay BA (EPA 2000a). The actions covered under that addendum are expected to require formal consultation pursuant to ESA.

Consistent with the 2000 Explanation of Significant Differences (ESD) (EPA 2000b), this Project applies all applicable conservation measures to avoid or minimize adverse impacts to aquatic habitat. Please see the standard habitat conservation measures described in "*5. Habitat Conservation Measures*" of this document for details on these measures.

Consistent with NOAA Fisheries and U.S. Fish and Wildlife Service (USFWS) guidance, Biological Evaluations/Assessments must contain specific information. The road map below serves as a guide to specific documentation containing the information for each aspect required for ESA consultation.

1. **Description of the Project:** Work to occur during the 2003 construction season that is covered in this road map includes land-based intertidal remediation, demolition and bank cleanup, and relocation of a portion of the Hylebos Marina. Descriptions of these actions are presented below.

   - **Intertidal Remediation**

     Intertidal remediation activities are proposed for the following areas (Drawing IA-1, attached):

     - General Metals Graving Slip, SMA 203
     - ATOFINA Intertidal Area of SMA 221
     - Dunlop Log Haulout, SMA 242
     - J&G Boat Haulout, SMA142

     Remediation activities during the 2003 construction season will involve land-based excavation (using excavators, dozers and dump trucks) of littoral areas at portions of the above-listed Sediment Management Areas (SMAs). All excavation will occur above elevation 0 feet mean lower low water (MLLW) (with the exception of 0.2 acres of littoral habitat extending down to –1.5 feet MLLW at the General Metals Graving Slip) when there is at least a 2-foot horizontal differential between the waterward edge being actively worked and the tide level. Therefore, for the purpose of this road map, none of the intertidal remediation occurring during the 2003 construction season is described as taking place "in-water," so as to distinguish these efforts from other activities (e.g., salt pier demolition) that will entail in-water work during a different approved work period. A total of 3.4 acres of littoral habitat will be remediated between mean higher high water (MHHW) and 0 feet MLLW. In addition, 0.2 acres of littoral habitat extending down to –1.5 feet MLLW will be remediated at the General Metals Graving Slip (Drawing C-37, attached).

Intertidal remediation below MHHW is scheduled to begin on June 12, 2003 and is expected to continue through fall 2003. This work period is proposed to encompass a period of daytime extreme low tides that will provide optimum conditions for land-based remediation using methods that minimize the risk to listed species. Much of the intertidal remediation excavation will be focused on the following dates due to the favorable tides:

- June 12-17, 2003 (6 days), lows range from -2.1 to –3.9 feet MLLW
- June 29-July 2, 2003 (4 days), lows range from -1.9 to –2.2 feet MLLW
- July 11-15, 2003 (5 days), lows range from -2.6 to –3.5 feet MLLW
- July 29, 2003 (1 day), lows extend to -2.0 feet MLLW
- August 9-12, 2003 (4 days), lows range from -2 to –2.4 feet MLLW

Intertidal remediation may also occur on other days during the period from June 12 to July 15, consistent with the requirement that the water level be at least 2 horizontal feet from the waterward edge being worked. Details on all construction activities and their timing are outlined in Table 2 at the end of this section, "*1. Description of the Project.*"

Sediments removed from the intertidal remediation areas will be disposed of at an approved upland location.

- **Demolition and Bank Cleanup**
  - **Demolition**. Drawing D-2, attached, identifies the shoreline demolition of structures scheduled for the 2003 construction season. These structures must be removed to allow intertidal remediation and bank cleanup to occur. The timber pile bulkheads located along littoral slopes will be removed using land-based equipment when the tides are out so the work is completed out-of-water (Drawing D-2, Photo inserts 4-6).

    The in-water structures will be removed using water-based equipment operating during the normal in-water work period. Details on all construction activities and their timing are outlined in Table 2 at the end of this section, "*1. Description of the Project.*" The in-water structures that will be removed are shown on Drawing D-2, from left to right, as follows:

    - Diffuser Pier (concrete pile structure) (Drawing D-2, Photo insert 1)
    - Salt Pier (creosote-treated timber structure) (Drawing D-2, Photo insert 2)

- Rail Road Trestle Bents (piling-supported steel structures) (Drawing D-2, Photo insert 3)

Materials removed from the demolition sites will be disposed of at an approved upland location.

- **Bank Cleanup.** The sediment and soil on the banks adjacent to the areas requiring remediation do not exceed SQOs, and as such do not now require specific remedial action. However construction debris and creosote-treated timber bulkheads are present along the face of some of the banks. Typically the bank material is found from the top of the bank (typically elevation +17 to +18 feet MLLW) extending in some cases down into high littoral elevations. A total of 0.9 acres of bank will be cleaned up between MHHW and 0 feet MLLW.

  ATOFINA and General Metals have identified portions of their shoreline banks that will be cleaned up and stabilized to limit the future potential of erosion of debris and other materials onto the shoreline. These areas are shown on Drawing IA-1 with yellow shading. The bank cleanup activities will extend from the top of the bank to high littoral elevations (typically +7 feet MLLW and higher).

  The portions of the banks located above +12 feet MLLW (MHHW) will be cleaned up prior to the intertidal remediation. Portions of the bank that are located lower than MHHW will be cleaned up after the adjacent intertidal remediation is complete, so as to avoid contamination of clean bank materials. If material suspect of chemical contamination is encountered in the bank excavations, such as stained soil or waste containers, it will be separated from the bank material and handled appropriately.

  The bank cleanup actions will occur using land-based equipment (i.e., excavators, dozers and dump trucks). The upland work (above MHHW) will be initiated in May 2003, and may occur year round, seven days a week, 24 hours a day. To eliminate the risk of fish stranding, a berm of existing material will be left on the waterward edge of the upland excavations until such time that the entire excavated area can be graded to drain freely to the waterway. The berm will have a minimum top elevation of +14 feet MLLW to prevent overtopping by the highest tide that occurs during May and June of 2003 (+13.1 feet MLLW). No excavated upland will be connected to the waterway until June 12. From June 12 to July 15 all upland areas that are excavated and connected to the waterway will be graded to drain freely to the waterway prior to connection to avoid the potential for fish stranding. Details on all construction activities and their timing are outlined in Table 2 at the end of this section, "*1. Description of the Project.*"

  Materials removed from the bank cleanup sites will be disposed of at appropriate upland locations. The specific scopes of the bank cleanup at ATOFINA and General Metals include the following.

- **ATOFINA** – In most cases, the bank along the ATOFINA property will be pulled back to approximately 10 feet behind the existing fence line to flatten the over-steepened slope (Drawing IA-1). The westernmost 700 feet of the ATOFINA shoreline, extending from the edge of the dock to the property line with Thermafiber, will be pulled back 60 feet to 120 feet (note: a portion of this action may be delayed until after the dredging during the 2004 construction season in order to maintain the salt pads in working order). The existing upland will be cut at approximately a 2H:1V slope from the top of bank to elevation +9 feet MLLW, and then at a 10H:1V slope from +9 feet MLLW until it reaches the existing slope at 0 feet MLLW (Drawing C-12, attached). Bank cleanup at the ATOFINA site will include the removal of old construction debris (e.g., bricks, concrete, etc.) that have been exposed by shoreline erosion or accumulated along the shoreline (Drawing D-2). The newly exposed surface resulting from the above-mentioned actions will be covered with 1 to 2 feet of Transition Zone Grading Material (TZGM) "select substrate", containing well-graded, naturally rounded sand and gravel material (Table 1). The bank cleanup will result in a high littoral bench along the length of the ATOFINA property shoreline.

Table 1. Grain size criteria for the TZGM select substrate.

Sieve Size	Percent Passing
6" square	100%
US No. 4	80% max
US No. 40	50% max
US No. 200	10% max

- **General Metals** – The top of the peninsula along the General Metals Graving Slip, which is currently at an elevation of +17 feet MLLW, will be excavated to approximately +7.5 feet MLLW; this cut back will remove previously placed fill containing debris that has the potential to erode onto the beach (Drawings IA-1 and C-37). A 1.5-foot layer of quarry spalls will be placed to stabilize the excavated portion of the peninsula from the crest to 0 feet MLLW on the waterway side of the peninsula. The entire peninsula will then be topped with a 1-foot layer of TZGM select substrate to an elevation no deeper than 0 feet MLLW. The finished grade of the existing peninsula will be approximately +10 feet MLLW. In Addition, 4-foot diameter rocks will be dispersed along the top of the peninsula to diffuse wave action; they will be staggered in two rows, and placed on approximate 6-foot centers. Seven large woody debris (LWD) structures will also be placed on top of the peninsula after bank cleanup actions are complete to contribute to habitat complexity of the site.

- **Hylebos Marina Relocation**

  Completing the necessary marina moves and waterway dredging in the 2004 construction season requires that specific preparations be made for the work during the 2003 construction season. Specifically, the 2003 work calls for relocation of a portion of the marina, as shown on Figure M-2 (attached). The designated Hylebos Marina floats and boathouses will be relocated outside of the dredging area during the 2003 construction season to locations presented on Figure M-2. This component of the Project will necessitate the installation of approximately 10 to 15 piling to anchor the structures in the new location. An old piling-supported barge extending over the littoral habitat will also be removed from the property (shown on Figure M-2); the piling supporting the barge are scheduled to removed during the in-water demolition of structures at ATOFINA. In addition, a new travel lift pier will be built to provide for ongoing operations of the Hylebos Marina, as the existing travel lift (Figure M-1) will be removed to facilitate dredging during the 2004 construction season (shown on Figure M-2).

  All temporarily relocated floats and moorage will be positioned waterward of the –10 ft MLLW contour to avoid shading of littoral habitat. Access to the relocated facilities will be by existing gangways. After dredging of the eastern two-thirds of the Middle Turning Basin is completed during the 2004 construction season (Figure M-3, attached), the marina will be reconfigured to a permanent location. Details on the dredging and this reconfiguration will be covered in the separate addendum to the Commencement Bay BA.

Table 2. Construction activities and corresponding work periods and habitat conservation measures.

Activity	Descriptions	[illegible]	Cons[illegible]atio[illegible] Measures
Intertidal Remediation	Land-based excavation of sediments exceeding SQOs between MHHW and 0 feet MLLW [2]. Work between MHHW and 0 feet MLLW to occur in the dry.	June 12 - July 15 July 16 - February 14	Standard plus Additional Standard
Bank Demolition	Timber pile bulkheads removed to facilitate remediation and cleanup activities using land-based equipment. Work between MHHW and 0 feet MLLW to occur in the dry.	June 12 - July 15 July 16 - February 14	Standard plus Additional Standard
Bank Cleanup	Removal of uncontaminated materials from the shorelines. Work between MHHW and 0 feet MLLW to occur in the dry.	June 12 - February 14	Standard
In-water Demolition	Removal of the Diffuser Pier, Salt Pier, and Rail Road Trestle Bents to occur using water-based equipment.	July 16 - February 14	Standard
Hylebos Marina Relocation	Relocating boathouses, driving new piling and constructing new travel lift pier to occur using water-based equipment	July 16 - February 14	Standard

[1] Habitat Conservation Measures are described and presented as two lists (Standard and Additional) below in "5. *Habitat Conservation Measures*."

[2] The exception to the 0 feet MLLW limit of work is that 0.2 acres extending from 0 feet MLLW down to –1.5 feet MLLW will be remediated at the General Metals Graving Slip.

2. **Description of habitats in the Project Area:** The Hylebos Waterway shoreline habitat was characterized in detail previously (Hylebos Waterway Potential SMA Sites Habitat Assessment and Evaluation [PIE 1999]). Much of the south shoreline of the Hylebos Waterway consists of engineered slopes ranging from gently sloped to vertical (resulting from bulkheads). Areas that will be remediated or cleaned up during this Project typically contain timber bulkheads or riprap in the upper elevations, and fine mud and gravel in the lower elevations (Drawing D-2, Photo inserts 1-6). Littoral vegetation is limited, as are attached organisms. The J&G Boat Haulout portion of the northeast shoreline of the Hylebos Waterway is similar to the south shoreline in that it is also very steeply sloped and does not have much vegetation or organism coverage. The peninsula at the General Metals Graving Slip has a steeper slope at higher elevations, and a shallower slope at lower elevations (Drawing D-2, Photo inserts 7-8). There is little macroalgae present, and limited non-native upland vegetation.

   Baseline habitat conditions in Commencement Bay are also described in the Commencement Bay BA (EPA 2000a). Specific sections of the BA that describe the habitat quality are listed below.

   - **Water Quality**
     - **Turbidity** – Commencement Bay BA Section 7.1.
     - **Dissolved Oxygen** – Commencement Bay BA Section 7.2.
     - **Water Contamination** – Commencement Bay BA Section 7.3.
     - **Sediment Contamination** – Commencement Bay BA Section 7.4.
   - **Estuarine Habitat Quality**
     - **Estuarine Habitat Area, Diversity, and Accessibility** – Commencement Bay BA Section 7.5.
     - **Salt/Fresh Water Mixing Patterns and Locations** – Commencement Bay BA Section 7.6.
     - **Shoreline Modifications** – Commencement Bay BA Section 7.7.
     - **Current Patterns** – Commencement Bay BA Section 7.8.
   - **Biological Habitat Quality**
     - **Epibenthic Prey Availability** – Commencement Bay BA Section 7.9.
     - **Forage Fish Community** – Commencement Bay BA Section 7.10.

3. **Summaries of species life histories and habitat use in the Project Area, and potential effects:** Listed species life history and habitat use information, and potential effects on these species are described in the Commencement Bay BA (EPA 2000a). Specific sections that cover the given species are listed below. Additional information regarding the effects of the specific intertidal remediation, demolition and bank cleanup actions to occur during the 2003 construction season on listed species is also included below.

   - **Puget Sound Chinook Salmon** – Commencement Bay BA Section 6.1.1. This section of the BA describes the life history and habitat use of chinook salmon, while specific effects of the actions on salmonids and their habitat are discussed in detail below in "*4. Analysis of potential effects on salmonids and their habitats.*"

- **Bull Trout** – Commencement Bay .BA Section 6.1.2. This section of the BA describes the life history and habitat use of bull trout, while specific effects of the actions on salmonids and their habitat are discussed in detail below in "*4. Analysis of potential effects on salmonids and their habitats.*"
- **Bald Eagle** – Commencement Bay BA Section 15.1. The primary mechanisms for impact discussed in the BA were short-term turbidity and construction noise, and the effects they might have on foraging and food availability in the vicinity of the Project Area. Because only limited localized turbidity and in-water construction noise will result from the land-based activities, demolition and marina relocation activities occurring in 2003, no long-term effects on bald eagles or their forage fish are expected.
- **Steller Sea Lion** – Commencement Bay BA Section 15.2. The BA described potential effects on Steller sea lions resulting from turbidity, direct disturbance from construction equipment, and disturbance to food resources. Because the work covered by this road map will be land-based and occur in the dry, or be limited to demolition and marina relocation work that will not produce a large amount of turbidity, no additional effects to Steller sea lions are expected.
- **Humpback Whale** – Commencement Bay BA Section 15.3. Potential mechanisms for impacts on humpback whales described in the BA included turbidity, direct disturbance from construction equipment, and disturbance to food resources. These mechanisms will be limited by the work described here, as work will either occur in the dry using land-based equipment, or involve limited in-water demolition and marina relocation activities. Therefore, no effects on humpback whales are expected.
- **Leatherback Sea Turtle** – Commencement Bay BA Section 15.4. The primary mechanisms for impact discussed in the BA were turbidity, direct disturbance from construction equipment, and disturbance to food resources. Because only limited localized turbidity and in-water construction (during demolition and marina relocation) will result from the activities occurring in 2003, no effects on leatherback sea turtles are expected.

Additional potential effects on listed salmonids based on indicators of habitat quality are discussed below in "*4. Analysis of potential effects on salmonids and their habitats.*" With the exception of the final "*6. Effects determination*" below, there is no further discussion concerning effects on other listed non-salmonid species.

4. <u>**Analysis of potential effects on salmonids and their habitats:**</u> Project construction is not expected to adversely affect juvenile salmonids, as the in-water portion of this Project would be conducted during the established in-water work period approved by NOAA Fisheries and USFWS. This would ensure that in-water work does not occur during the period when juvenile salmonids (smolts) are abundant in the Project Area. Sub-adult or adult bull trout could be present in very low numbers during construction. There is little risk of direct mortality of salmonids from intertidal remediation, demolition or bank cleanup activities, as these activities are being conducted in the dry when the water level has receded a minimum of 2 horizontal feet from the waterward edge being worked. Mortality of salmonids resulting from stranding is not expected, as appropriate measures will be taken through retaining berms or grading appropriate slopes to ensure that no fish become trapped when upland excavations are occurring during period of high tides. No direct effects on salmonids are expected to result from the marina relocation activities, as they will take place during the standard construction season, when salmonids are not likely present in high numbers. Additionally, only limited, localized turbidity is expected to result from marina relocation activities.

Ecological pathways and indicators reflect the essential features of designated habitat for salmonids. The following is a summary of potential effects on salmonids based on indicators of habitat quality.

- **Water Quality**
  - **Turbidity** – Very limited localized turbidity may result from in-water demolition actions, as the work is limited to demolition of relatively small structures within the normal work period. Additionally, turbidity resulting from the marina relocation (i.e., driving 10 to 15 piling and removal of the barge) is expected to be localized and temporary. Any turbidity associated with the out-of-water remediation, demolition and bank cleanup work (between MHHW and 0 feet MLLW) would be the result of the tide washing over newly excavated sediments. Very low daytime tides will assist in preventing sediments from falling into the water during excavation activities, as the low tides extend down to 3.9 feet below the 0 feet MLLW extent of work. In the long term, cleanup actions along the shoreline will result in stabilization of sediments to prevent future erosion of unsuitable sediments due to placement of TZGM select substrate. Therefore, the Project will **improve** the long-term baseline condition for this indicator.
  - **Dissolved Oxygen** – Because no excavation or placement of TZGM select substrate will occur in-water, and only limited turbidity may occur from these actions, demolition or marina relocation, no change in dissolved oxygen levels is expected. The Project will **maintain** the baseline condition for this indicator.
  - **Water Contamination** – Although no in-water work will be allowed during the intertidal remediation and bank cleanup actions, accidental spills of chemicals could occur in conjunction with machinery operation during these actions or the demolition and marina relocation work. As part of the Project Best Management Practices (BMPs), the construction contractor will be responsible for the preparation of spill response and hazardous material control plans to be used for the duration of the work period. The plan will outline measures to be taken to prevent the release or spread of hazardous materials, including (but not limited to) gasoline,

oils, and chemicals. Water contamination resulting from excavated sediment falling into the water during actual construction activities, or from newly exposed sediments having contact with the water when the tide rises, is expected to be minor. The Project is expected to **maintain** the baseline condition for this indicator.

- **Sediment Contamination** – Intertidal remediation activities will remove contaminated sediments from the shoreline, and bank cleanup activities will include stabilization of sediments. These activities will prevent future erosion of unsuitable materials onto the shoreline. Therefore, the Project will **improve** the baseline condition for this indicator.

- **Estuarine Habitat Quality**
  - **Area, Diversity, & Accessibility** – The remediation and cleanup activities occurring during the 2003 construction season will result in the conversion of 1.9 acres of upland into aquatic (specifically littoral) habitat. The resulting littoral habitat will offset the habitat conversion of littoral habitat to subtidal habitat (to occur during the 2004 construction season's dredging activities) and will contribute to the final Post-Project net gain (after the 2004 construction season) of 0.1 acres of littoral habitat. Additionally, shading of the littoral zone will be reduced as a result of activities in both construction seasons (see *Shoreline Modifications* section below). Although excavation of the littoral habitat, demolition and marina relocation will result in a temporary disturbance of the epibenthic community, recolonization is expected to occur quickly (see *Biological Habitat Quality* section below). Overall, the amount and quality of habitat utilized by salmonids (the littoral habitat) is improving as a result of the Project activities occurring during the 2003 and the 2004 construction seasons. Therefore, the Project will **improve** the baseline condition for this indicator.
  - **Salt/Freshwater Mixing** – Excavation and placement of TZGM select substrate, demolition and relocation of part of the marina associated with this Project is limited to the Hylebos Waterway, and is not expected to affect the mixing function in the vicinity of the Project. The Project will **maintain** the baseline condition for this indicator.
  - **Shoreline Modifications** – The Project will include the removal of old construction debris, old timber bulkheads, dilapidated piers and piling and an old barge; these actions will improve the existing shoreline. Although a travel lift pier will be built during the 2003 construction season, there will be a net decrease (0.16 acres) in littoral habitat shading as a result of activities in both the 2003 and the 2004 construction seasons. This reduction of littoral habitat shading is beneficial to juvenile salmonids utilizing this habitat (i.e., traveling and feeding along the shoreline). Therefore, this Project will **improve** the baseline condition for this indicator.
  - **Current Patterns** – No remediation, cleanup, demolition or marina relocation activities associated with this Project are expected to affect

current patterns. Therefore, the Project will **maintain** the baseline condition for this indicator.

- **Biological Habitat Quality**
  - **Epibenthic Prey** – Substrate disturbance caused by excavation, placement of TZGM select substrate, demolition and marina relocation will cause a localized, short-term change in the epibenthic community. Marine algae and sessile invertebrates will be destroyed when existing materials are excavated and TZGM select substrate is placed along the shorelines at low tides. Additionally, the demolition of in-water structures would also contribute to a loss in organisms. This change could cause a short-term loss of productivity in those areas. However, the results of a number of studies at Port of Tacoma, Port of Seattle and other locations within urban environments examining the recolonization of littoral substrate that has been disturbed (Parametrix, Inc. 1985; Hiss et al. 1990; Jones & Stokes Associates, Inc. 1990a, 1990b, 1995) indicated that recolonization is rapid and that substantial densities of prey are available within a short period of substrate disturbance. The temporary loss of production resulting from this Project is not expected to result in any measurable effect on juvenile salmonids that may migrate past these areas in the year following construction. The new, cleaned up and stabilized shoreline (void of construction debris, bulkheads and the old barge) will improve habitat productivity by providing an increase in quantity and quality of habitat substrate for epibenthos; the resulting increase in habitat function will likely benefit migrating juvenile salmon. Further, the TZGM select substrate to be placed on the shoreline will assist in improving biological production in the vicinity of the Project as a result of improving habitat conditions for prey items of juvenile salmonids. In the long term, the Project will **improve** the baseline condition for this indicator.
  - **Forage Fish** – In-water work occurring during this Project (including demolition and marina relocation activities) will generate only minimal turbidity and construction noise. It is expected that forage fish will not be directly affected, as they will likely temporarily avoid the Project Area during demolition and marina relocation. Additionally, no spawning habitat will be impacted by any Project activities. Therefore, the Project will **maintain** the long-term baseline condition for this indicator.

5. **<u>Habitat Conservation Measures:</u>** The HHCG has incorporated several habitat conservation measures to avoid and minimize potential adverse impacts to chinook salmon and bull trout. Federal, state, and local permits contain conditions that are intended to reduce the potential for short-term effects from construction activities. Although the Project will not result in the need to obtain Federal or State permits (CERCLA actions are exempt from permitting requirements) the Project will comply with the substantive permitting requirements.

The following sections summarize avoidance and minimization measures that are applied to projects in marine and estuarine waters and would be habitat conservation measures for the intertidal remediation and cleanup actions. The conservations in the first section are "standard" habitat conservation measures that will be applied for all activities being performed. The second section outlines "additional" habitat conservation measures that will be applied over and above the standard measures, but only to intertidal remediation and demolition work occurring between MHHW and 0 feet MLLW, before July 16, 2003 (see Table 2).

- **Standard Habitat Conservation Measures**

  These habitat conservation measures will be applied to all activities performed during the 2003 construction season.

  - In order to protect listed threatened or endangered species, in-water remedial construction and demolition will not be allowed during fish-critical activity periods, defined as February 15 through July 15 each year. Although some excavation and demolition activities associated with this Project will take place before this date, they are not considered to be "in-water" work, and are not subject to this work closure.
  - Properly sized equipment will be used for all operations.
  - During construction, all prudent and necessary steps will be taken to avoid any discharge of oil, fuel or chemicals into waters, or onto land with a potential for entry into waters.
  - Fuel hoses, oil drums, oil or fuel transfer valves and fittings, etc., on construction equipment will be checked regularly for drips or leaks, and will be maintained and stored properly to prevent spills into waters. Proper security will be maintained to prevent vandalism.
  - In the event of a discharge of oil, fuel or chemicals into waters, or onto land with a potential for entry into waters, containment and cleanup efforts will begin immediately and be completed as soon as possible, taking precedence over normal work. Cleanup will include proper disposal of any spilled material and used cleanup materials.
  - Spills into waters, spills onto land with a potential for entry into waters, or other significant water quality impacts will be reported immediately to the Ecology's Southwest Regional Office (360) 407-6300 (a 24-hour phone number).
  - The Contractor will be required to capture debris associated with demolition activities (i.e., removal of piling and existing structures) and not allow it to enter the Hylebos Waterway.
  - A berm of existing material will be left (with a top elevation of at least +14 feet MLLW) during upland excavation that occurs before June 12 to eliminate the risk of fish stranding. The berm will be left until such a time that the entire excavated area can be graded to drain freely to the waterway. No excavated upland will be connected to the waterway until

June 12. From June 12 to July 15 all upland areas that are excavated and connected to the waterway will be graded to drain freely to the waterway to avoid the potential for fish stranding, prior to connection to the waterway.

- The Contractor will be required to have sand available in the unlikely event it is needed to cover a hole, resulting from piling removal, that is visibly releasing materials from the sediments.

- After intertidal remediation and bank cleanup activities are complete at the General Metals Graving Slip, seven LWD structures will be placed atop the peninsula to improve the habitat complexity of the site.

- The Construction Quality Assurance Plan (CQAP), which presents the systems through which the Contractor(s) assure that the requirements of the contract are being complied, has been prepared for the Project and submitted to the U.S. Environmental Protection Agency (EPA) for approval (Dalton, Olmsted & Fuglevand, Inc. 2002). If any construction activities operations are found not to be in compliance with the above-mentioned provisions or they result in conditions causing distressed or dying fish, the operator will immediately take the following actions.

  - Cease operations at the location of the violation.

  - Assess the cause of any water quality problem noted and take appropriate measures to correct the problem and/or prevent further environmental damage.

  - In the event of finding distressed or dying fish, the operator will collect fish specimens and water samples in the affected area and, within the first hour of such conditions, make every effort to have the water samples analyzed for DO and total sulfides.

  - Notify EPA, and other agencies as appropriate, of the nature of the problem, any actions taken to correct the problem, and any proposed changes in operations to prevent further problems.

- The 2000 ESD (EPA 2000b) determined that the remedial actions are not likely to jeopardize the continued existence of any federally listed threatened or endangered species or result in the destruction of or adverse impacts to critical habitat for these species. Consistent with the ESD (EPA 2000b), this Project applies the following conservation measures to avoid or minimize adverse impacts to aquatic habitat.

  - There will be a net gain of aquatic habitat area as a result of the Project.

  - There will be no net conversion of littoral habitat to subtidal habitat as a result of the Project. Instead, the Project yields a net gain of littoral habitat, and hence, additional function.

  - The existing overall baseline habitat characteristics (slope, area, substrate) at the Head of Hylebos Waterway will be maintained.

- TZGM select substrate that is placed in littoral habitat will assist in providing suitable habitat for juvenile salmonid prey items.
- Creosote-treated timber piling that are removed to facilitate access for dredging during the 2004 construction season, such as at Hylebos Marina, will not be put back into the marine environment, except for possible temporary (less than one year) use for temporary marina moorage. Replacement piling will be of an inert material, such as concrete, steel or untreated wood.

- **Additional Habitat Conservation Measures**

These additional habitat conservation measures will be applied only to intertidal remediation and demolition work occurring before July 16, 2003.

- Work at the four intertidal remediation locations will be sequenced so that the General Metals Graving Slip (SMA 203) and the J&G Boat Haulout (SMA 142) will begin during the first favorable low tide period (June 12-17, 2003). These sites have been chosen as the first in the sequencing of intertidal remediation and bank cleanup actions, as there are relatively small lengths of shoreline at the sites in contact with the waterway, and hence, less chance that contaminated sediments will come into contact with the waterway during this early period. Further, the General Metals Graving Slip was originally proposed as a natural recovery area due to the low levels of contaminants there. J&G Boat Haulout is also an area with lower levels of contamination. By beginning the remediation and cleanup activities at these two sites, the Project will accomplish the early removal of a larger volume of material with low levels of contaminants relative to the other sites.
- A containment boom will be installed in the water adjacent to the shoreline work areas prior to the commencement of any excavation activities. The boom will be a typical floating boom, such as an oil containment boom, with a few feet of material (e.g., rubber) extending down into the water column. The purpose of the boom will be to deter fish from entering the littoral habitat adjacent to the work being completed on the shoreline. The boom will be set on a daily basis to ensure that no fish are trapped within the contained area during low tides.
- After the containment boom is set around the work area each day, the Contractor will observe whether there are fish trapped within the area contained by the boom. If more than 10 fish are observed within the contained area, the Contractor will use the boom to "herd" the fish, and will release them into the waterway.
- Excavation occurring during the low tide periods will occur only when there is at least a 2-foot differential during the waterward edge being worked and the water level. To prevent incoming tides from disturbing sediments recently excavated, the Contractor will "back-blade" the sediments; that is, excavation equipment will be used to smooth the

sediment surface, decreasing the potential for turbidity to be created as the tide floods and wets the work area.

6. **Effects determination:** Based on the above referenced information, the construction activities described herein for the Head of the Hylebos Waterway Problem Area will have the following effects on federally listed threatened and endangered species:

- **Puget Sound chinook salmon** – may affect, but are not likely to adversely affect
- **Bull trout** – may affect, but are not likely to adversely affect
- **Bald eagle** – no effect
- **Steller sea lion** – no effect
- **Humpback whale** – no effect
- **Leatherback sea turtle** – no effect

If you have any questions regarding these determinations or this document, please do not hesitate to contact me at (509) 663-6300, or Paul Fuglevand at (425) 827-4588.

Sincerely,

Glenn Grette

Glenn Grette, Grette Associates
For Head of the Hylebos Cleanup Group

Enclosures

cc: Mat Cusma, General Metals of Tacoma, Inc.
Frederick G. Wolf, Ph.D., ATOFINA Chemicals, Inc.
Paul Fuglevand, Dalton, Olmsted & Fuglevand, Inc.
Rob Webb, Dalton, Olmsted & Fuglevand, Inc.
Mark Myers, Williams Kastner & Gibbs
Steve Parkinson, Ater Wynne
Russ McMillan, Washington State Department of Ecology
Robert Taylor, NOAA Fisheries

References:

Dalton, Olmsted & Fuglevand, Inc. 2002. Draft (90%) Construction Quality Assurance Plan (CQAP). Head of Hylebos Waterway Problem Area, Commencement Bay Nearshore/Tideflats Superfund Site, Tacoma, Washington. Prepared for the Head of Hylebos Cleanup Group (ATOFINA Chemicals, Inc. and General Metals of Tacoma, Inc.). December 16, 2002.

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Jones & Stokes Associates, Inc. 1995. Port of Tacoma Pier 7D mitigation monitoring, 1995. Prepared for the Port of Tacoma, Tacoma, Washington.

Pacific International Engineering (PIE). 1999. Hylebos Waterway Potential SMA Sites Habitat Assessment and Evaluation: Appendix C of the Hylebos Waterway Pre-Remedial Design Program Commencement Bay Nearshore/Tideflats Superfund Site Pre-Remedial Design Evaluation Report (Hylebos Cleanup Committee, November 1999). Prepared for the Hylebos Cleanup Committee. November 8, 1999.

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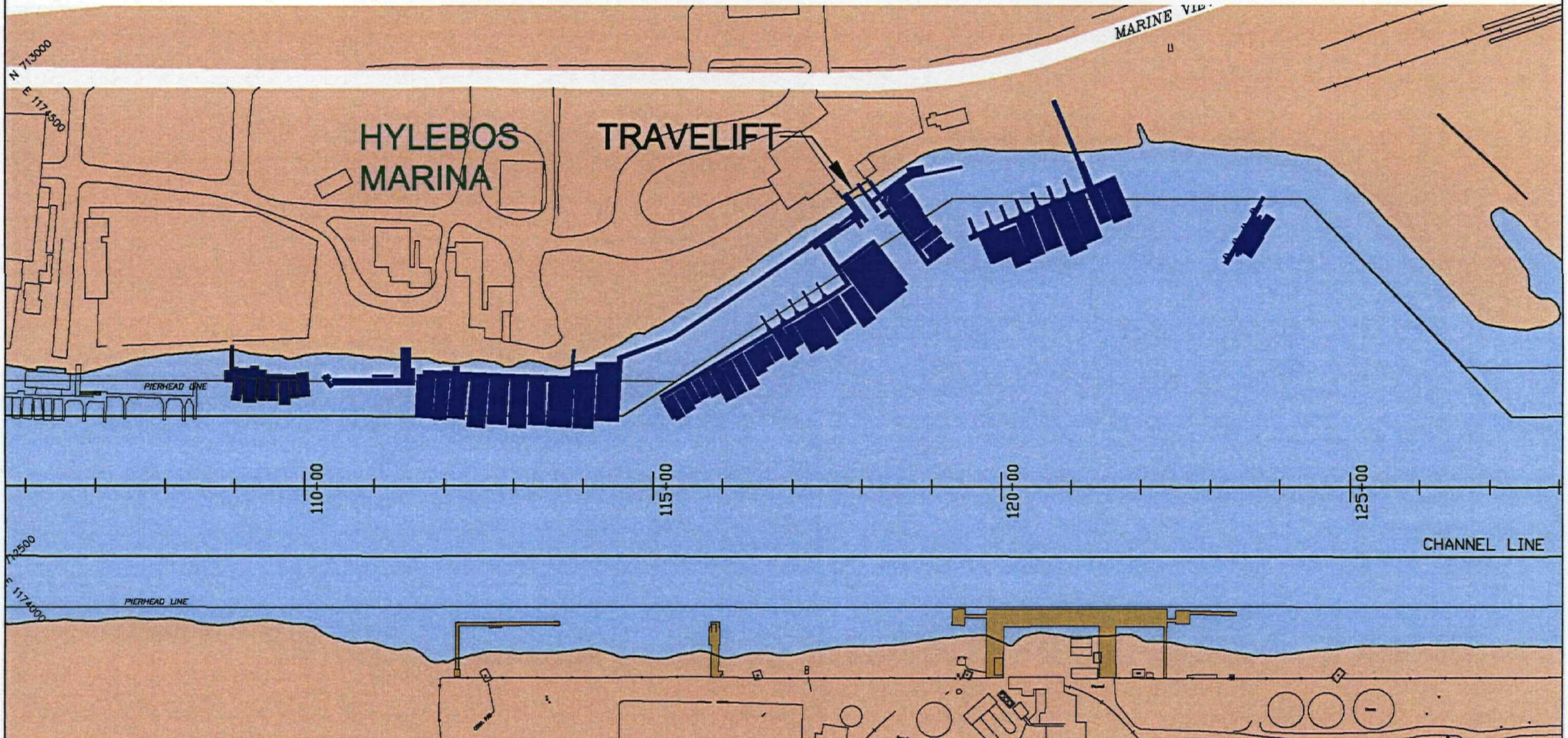
U.S. Environmental Protection Agency (EPA). 2000a. Biological Assessment Commencement Bay Nearshore/Tideflats Superfund Site. Response Action Contract No. 68-W-98-228. July 2000.

U.S. Environmental Protection Agency (EPA). 2000b. Explanation of Significant Differences Commencement Bay Nearshore/Tideflats Superfund Site. August 2000.

Head of the Hylebos Waterway Problem Area
ESA Consultation Documentation Draft "Road Map"

Attached Drawings and Figures

HYLEBOS MARINA DREDGING OPERATIONS PLAN
RELOCATION WITHIN TURNING BASIN



HHCG00102-40b

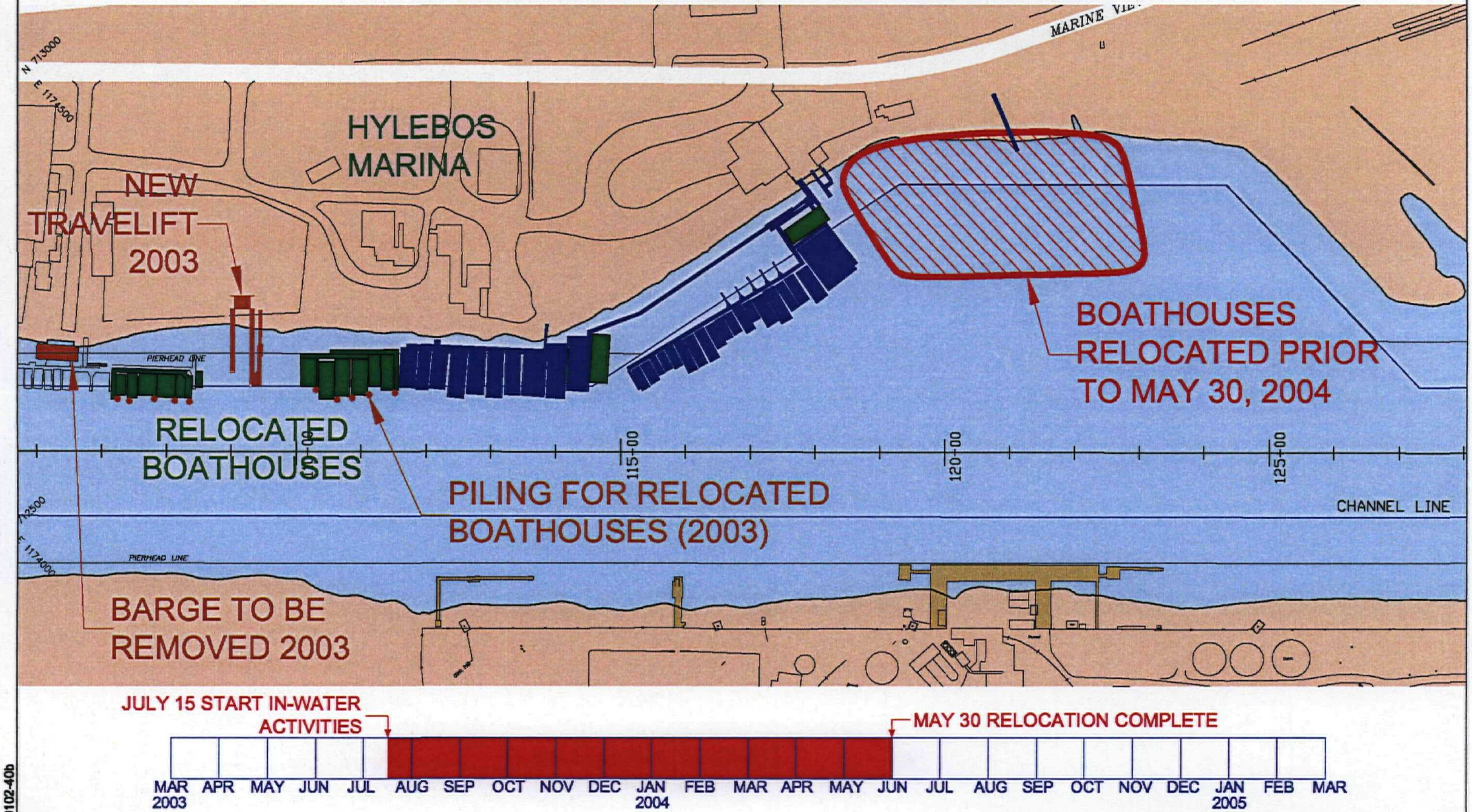
HEAD OF HYLEBOS WATERWAY

EXISTING CONDITION

HHCG00102 **FIGURE M-1** 03/21/03

Dalton, Olmsted & Fuglevand, Inc.

HYLEBOS MARINA DREDGING OPERATIONS PLAN
RELOCATION WITHIN TURNING BASIN



HHCG00102-40b

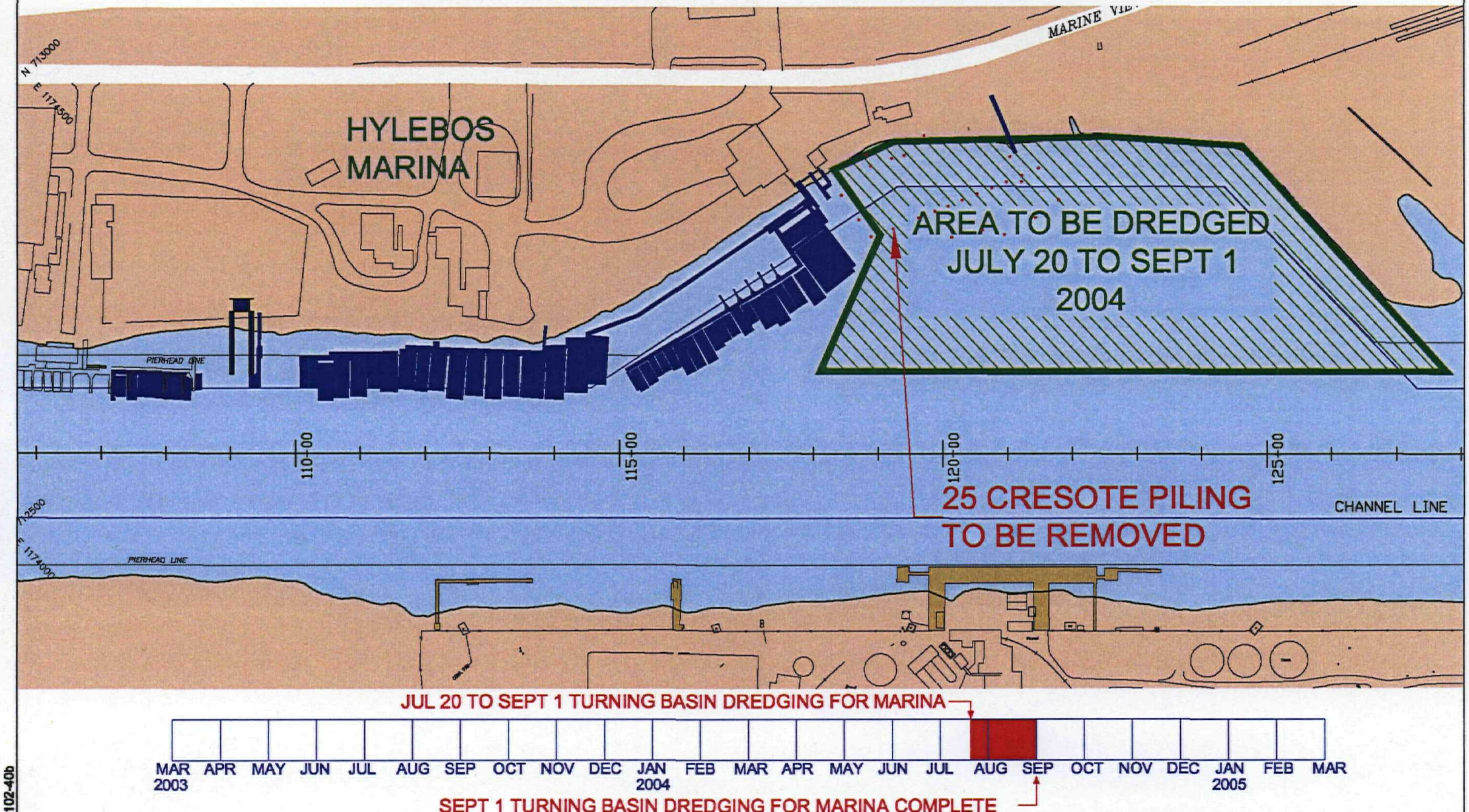
HEAD OF HYLEBOS WATERWAY

2003 THRU JUNE 2004
MARINA ACTIVITIES

HHCG00102 **FIGURE M-2** 03/21/03

Dalton, Olmsted & Fuglevand, Inc.

HYLEBOS MARINA DREDGING OPERATIONS PLAN
RELOCATION WITHIN TURNING BASIN



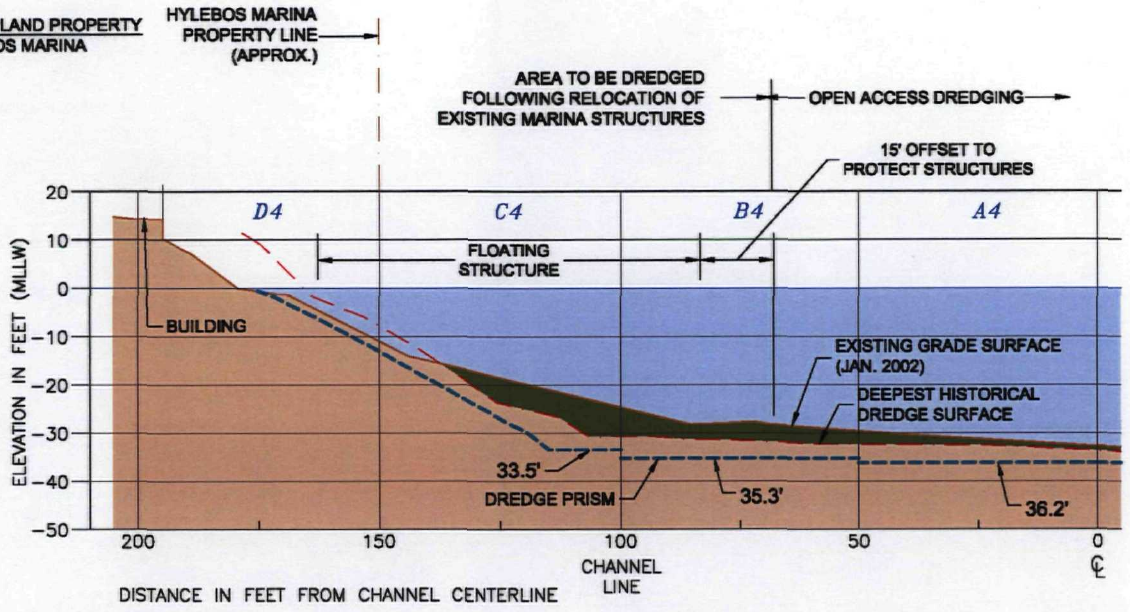
HEAD OF HYLEBOS WATERWAY

TURNING BASIN DREDGING FOR MARINA

HHCG00102 **FIGURE M-3** 03/21/03

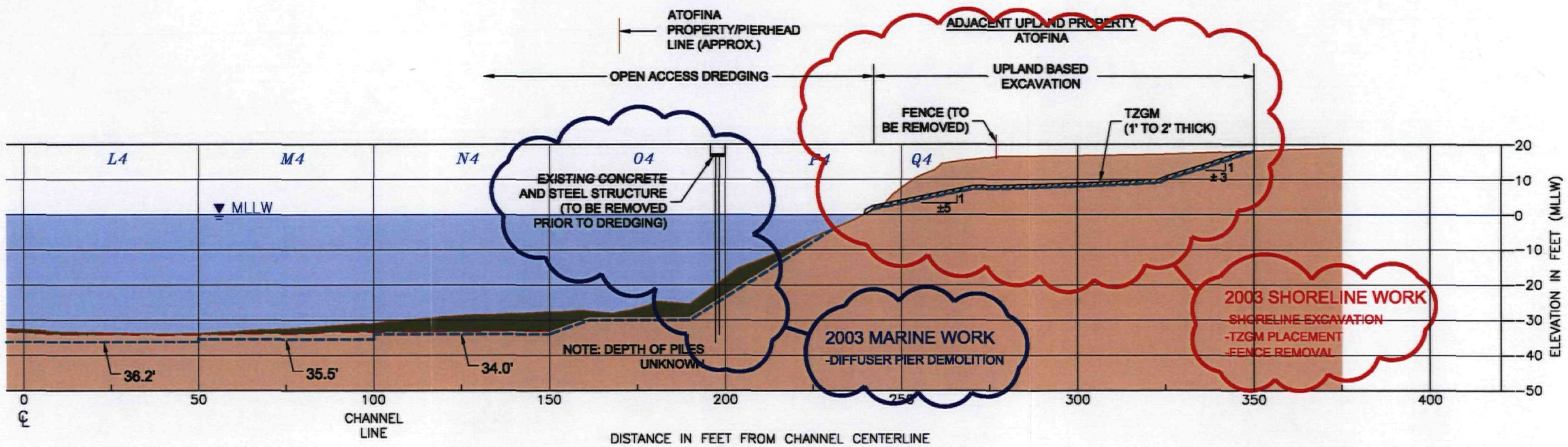
Dalton, Olmsted & Fuglevand, Inc.

HHCG00102-40b



LEGEND

- 2002 EXISTING GRADE SURFACE
- C.O.E. DEEPEST HISTORICAL DREDGE SURFACE
- DREDGE / EXCAVATION PRISM (SEE NOTE 8 BELOW)
- *A2* DREDGE MANAGEMENT AREA (DMA) DESIGNATOR
- 35.1' P2 TARGET DREDGE ELEVATION (MLLW) UNLESS CLEAN NATIVE MATERIAL IS ENCOUNTERED FIRST - SEE NOTE 8 BELOW
- RECENT SEDIMENT (TO BE DREDGED)
- NATIVE SEDIMENT
- TRANSITION ZONE GRADING MATERIAL (TZGM)

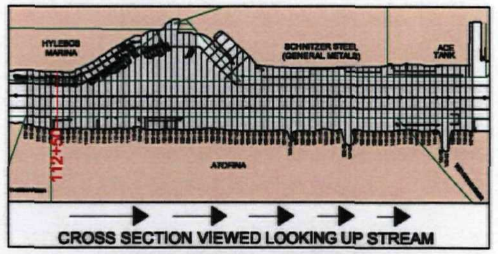


6 / C-4 Station 112+50

0 20 Scale in Feet

GENERAL NOTES:

1. ALL ELEVATIONS ARE REFERENCED TO N.O.S. MLLW (FEET) VERTICAL DATUM.
2. DEEPEST HISTORICAL DREDGE SURFACE DATA COMPILED FROM VARIOUS CORPS OF ENGINEERS HISTORICAL SURVEYS AND PERMIT APPLICATIONS.
3. EXISTING GRADE SURFACE DETERMINED FROM BATHYMETRIC SURVEY BY FOSTER WHEELER ENVIRONMENTAL CORP. JAN 2002, LEADLINES WITHIN HYLEBOS MARINA BY DALTON, OLMSTED & FUGLEVAND JUNE 2002 AND PHOTOGRAMMETRICALLY DERIVED CONTOURS BY WALKER AND ASSOCIATES MAY 2002.
4. STRUCTURE DATA DERIVED FROM PHOTOGRAMMETRICALLY MAPPED DATA (MAY 2002) AND PROPERTY OWNER PROVIDED DRAWINGS.
5. PROPERTY LINE BOUNDARIES DERIVED FROM CITY OF TACOMA PUBLIC WORKS DEPARTMENT GIS DATA SET. THIS DATA IS APPROXIMATE AND MAY NOT REFLECT ACTUAL RECORDED SURVEYS. PROPERTY LINE BOUNDARY FOR SCHNITZER STEEL (GENERAL METALS) AND HYLEBOS MARINA FROM RECORD OF SURVEY PERFORMED BY SITTS & HILL ENGINEERS, INC., OCTOBER 2002.
6. FLOATING STRUCTURES AT HYLEBOS MARINA INCLUDE MARINA DOCK & PRIVATELY OWNED BOATHOUSES.
7. DREDGE PRISM SIDE SLOPES VARY THROUGHOUT PROJECT BASED UPON SITE CONDITIONS. SLOPE SHOWN IS TARGET DEPTH WHICH MAY BE ADJUSTED DURING DREDGING BASED UPON ACTUAL DEPTH OF CLEAN SEDIMENT.
8. DREDGE PRISM SHOWN IS TARGET DEPTH FOR SECOND PASS DREDGING. ACTUAL DREDGING WILL PROCEED UNTIL CLEAN NATIVE MATERIAL IS ENCOUNTERED BASED UPON VISUAL OBSERVATION OF DREDGED SEDIMENT.



CROSS SECTION LOCATOR MAP

DRAFT

DALTON, OLMSTED & FUGLEVAND, INC.
Environmental Consultants
10705 Silverdale Way NW Suite 201
Silverdale, WA 98383

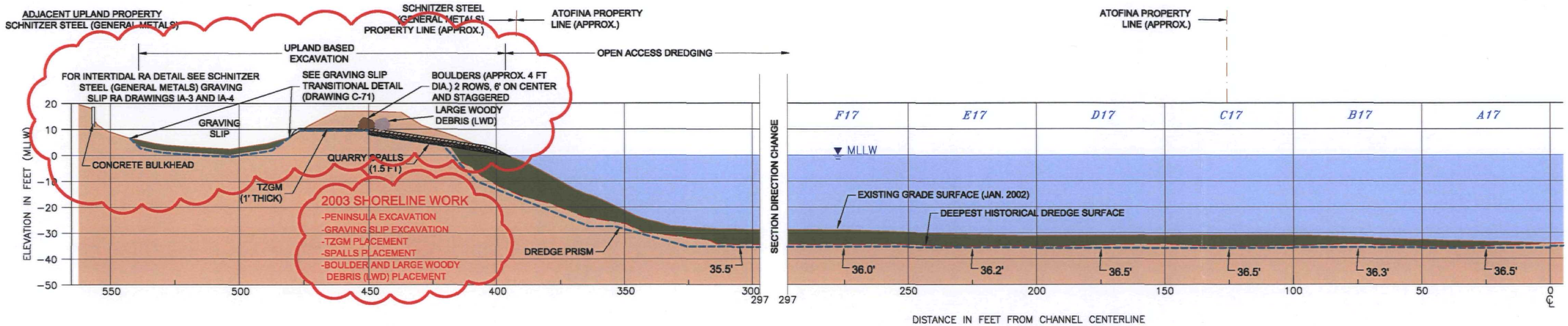
REVISIONS				
REV	DATE	BY	APP'D	DESCRIPTION

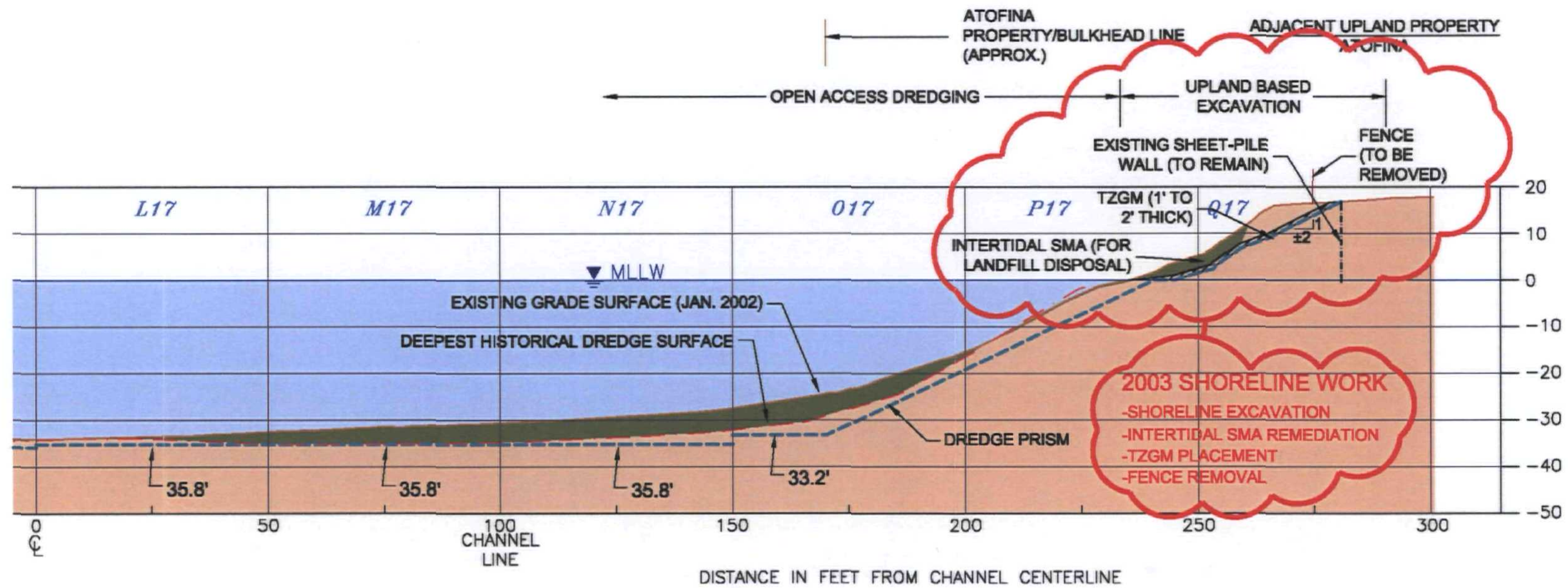
DESIGNED BY: R. WEBB/L. BARRAS
DRAWN BY: L. BARRAS/B. JOHNSTON
CHECKED BY: R. WEBB
APPROVED BY: P. FUGLEVAND
FILE: HCCG00102-03
DATE: 03/21/03

90% REMEDIAL ACTION DESIGN DELIVERABLE
HEAD OF HYLEBOS WATERWAY

CROSS SECTION SHEET 4
STATION 112+50
DMA ROW 4

DRAWING NO. C-12
PROJECT NO. HHCG00102
SHEET NO. 14 OF 91





LEGEND

- 2002 EXISTING GRADE SURFACE
- C.O.E. DEEPEST HISTORICAL DREDGE SURFACE
- DREDGE / EXCAVATION PRISM (SEE NOTE 8 BELOW)
- A2 — DREDGE MANAGEMENT AREA (DMA) DESIGNATOR
- 35.1' — P2 TARGET DREDGE ELEVATION (MLLW) UNLESS CLEAN NATIVE MATERIAL IS ENCOUNTERED FIRST - SEE NOTE 8 BELOW
- RECENT SEDIMENT (TO BE DREDGED)
- NATIVE SEDIMENT
- TRANSITION ZONE GRADING MATERIAL (TZGM)

31 / C-5 Station 125+00

0 20 Scale in Feet

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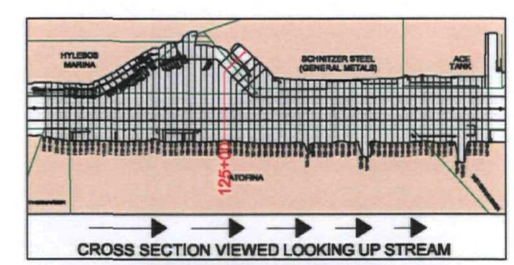


CROSS SECTION LOCATOR MAP

DRAFT

DALTON, OLMSTED & FUGLEVAND, INC.
Environmental Consultants
10705 Silverdale Way NW Suite 201
Silverdale, WA 98383

REVISIONS

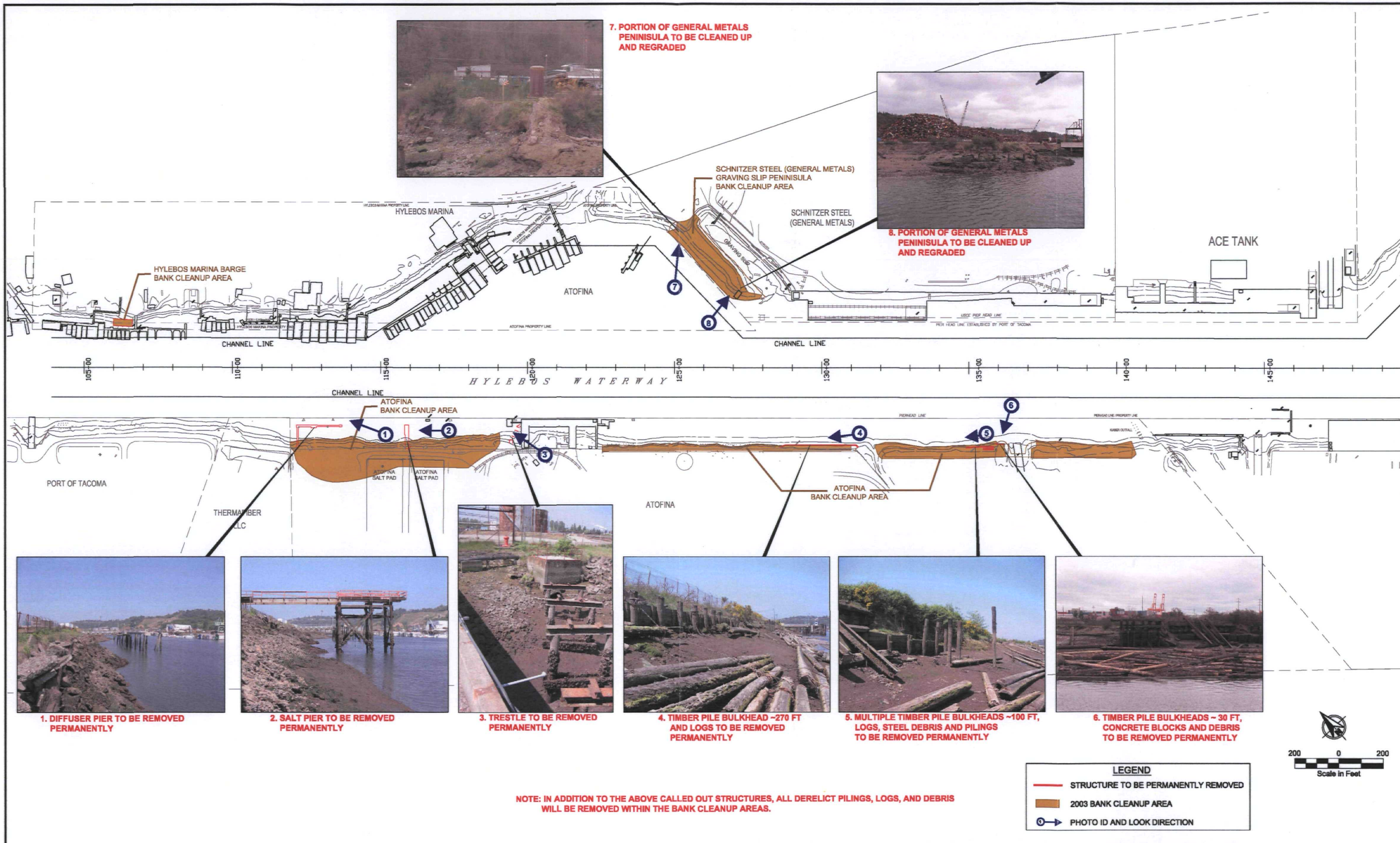
REV	DATE	BY	APP'D	DESCRIPTION

DESIGNED BY: R. WEBB/L. BARRAS
DRAWN BY: L. BARRAS/B. JOHNSTON
CHECKED BY: R. WEBB
APPROVED BY: P. FUGLEVAND
FILE: HCCG00102-04
DATE: 03/21/03

90% REMEDIAL ACTION DESIGN DELIVERABLE
HEAD OF HYLEBOS WATERWAY

CROSS SECTION SHEET 29
STATION 125+00
DMA ROW 17

DRAWING NO. C-37
PROJECT NO. HHCG00102
SHEET NO. 39 OF 91



DALTON, OLMSTED & FUGLEVAND, INC.
Environmental Consultants
10705 Silverdale Way NW Suite 201
Silverdale, WA 98383

GENERAL NOTES:

1. BASE MAP FEATURES AND CONTOURS PHOTOGRAMMETRICALLY MAPPED BY WALKER AND ASSOCIATES, MAY 2002.
2. PROPERTY LINE BOUNDARIES (OTHER THAN HYLEBOS MARINA AND SCHNITZER STEEL) DERIVED FROM CITY OF TACOMA PUBLIC WORKS DEPT. GIS DATA. THIS DATA IS APPROXIMATE AND MAY NOT REFLECT ACTUAL RECORDED SURVEYS. HYLEBOS MARINA AND SCHNITZER STEEL PROPERTY LINES FROM SITTS & HILL ENGINEERING RECORD OF SURVEY A.F.N. 2002211015001, NOVEMBER 2002.

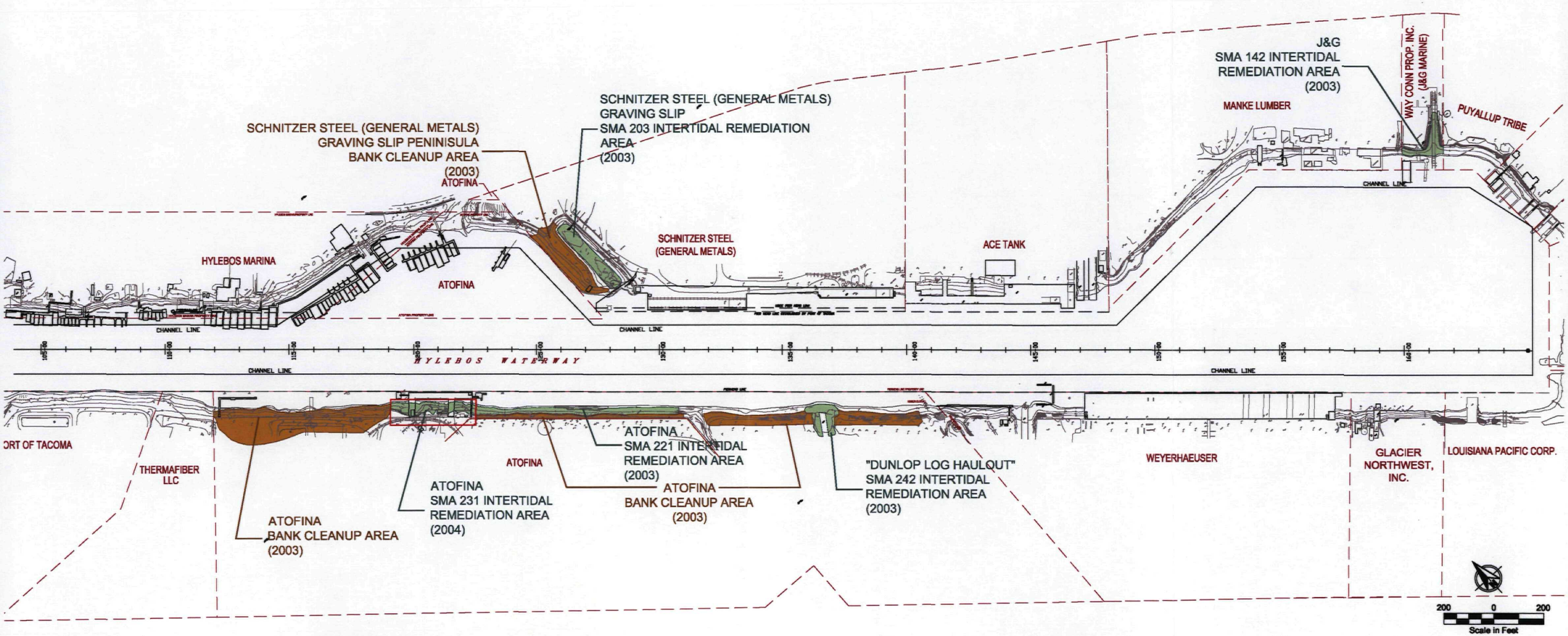
REVISIONS				
REV	DATE	BY	APP'D	DESCRIPTION

DESIGNED BY: R. WEBB/L. BARRAS
DRAWN BY: L. BARRAS/B. JOHNSTON
CHECKED BY: R. WEBB
APPROVED BY: P. FUGLEVAND
FILE: HCCG00102-42
DATE: 03/21/03

90% REMEDIAL DESIGN DELIVERABLE
HEAD OF HYLEBOS WATERWAY

2003 DEMOLITION MAP

DRAWING NO. D-2
PROJECT NO. HHCG00102
SHEET NO. 76 OF 91



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LEGEND
- INTERTIDAL REMEDIATION AREAS
- BANK CLEANUP AREAS

DRAFT

DALTON, OLMSTED & FUGLEVAND, INC.
Environmental Consultants
10705 Silverdale Way NW Suite 201
Silverdale, WA 98383

REVISIONS				
REV	DATE	BY	APP'D	DESCRIPTION

DESIGNED BY: R. WEBB/L. BARRAS
DRAWN BY: L. BARRAS
CHECKED BY: R. WEBB
APPROVED BY: P. FUGLEVAND
FILE: HCCG00102-29
DATE: 03/21/03

90% REMEDIAL ACTION DESIGN DELIVERABLE
HEAD OF HYLEBOS WATERWAY

LAND-BASED EXCAVATION AREAS
KEY MAP

DRAWING NO. IA-1
PROJECT NO. HHCG00102
SHEET NO. 78 OF 91

E - 2003 Access

Appendix E
2003 Access Agreements

(Submitted under separate cover)

WAY CONN PROPERTIES, INC.
P.O. Box 9203
Sylmar, CA 91392

March 13, 2003

Head of Hylebos Cleanup Group
Fred Wolf
ATOFINA Chemicals
2901 Taylor Way
Tacoma, WA 98421-4330

Head of Hylebos Cleanup Group
Mat Cusma
General Metals of Tacoma
P.O. Box 10047
Portland, OR 97210

RE: Site Access for Head of Hylebos Remediation Project
Way Conn Properties, Inc.
1690 Marine View Drive, Tacoma, WA 98422

Gentlemen:

Way Conn Properties has been contacted on behalf of your group regarding access to our property during the proposed intertidal remediation project. We understand that the area scheduled for remediation is the intertidal area shown on the attached figure, which was provided by the Head of Hylebos Cleanup Group's (HHCG) consultant (Paul Fuglevand of Dalton, Olmsted & Fuglevand, Inc.).

When Way Conn purchased the property in 1996, it executed an agreement with the United States Environmental Protection Agency ("EPA") titled "Agreement and Covenant Not to Sue Re Jones-Goodell Property Sediment Çontamination Located Within the Commencement Bay Nearshore/Tideflats Superfund Site" ("Agreement"). The Agreement stated, in part, that settling respondent "agrees to cooperate fully with EPA in the implementation of response actions at the CB N/T Site and further agrees not to interfere with such response actions. EPA agrees, consistent with its responsibilities under applicable law, to use reasonable efforts to minimize any interference with the Settling Respondent's operations by such entry and response." (See Agreement paragraph 32.) You have advised Way Conn that the HHCG is performing the "response actions" under EPA oversight.

This letter confirms that Way Conn will comply with the site access requirements and will work with the HHCG to coordinate necessary access for remedial design and remediation work. The HHCG, in turn, agrees to coordinate with Way Conn to reduce, when reasonably practicable, business disruptions associated with this work. Please provide me with a proposed work schedule and keep me informed of any changes to the schedule as the project continues. Our contact person on site will be Dan Hyland, 1690 Marine View Drive, Tacoma, WA 98422; Phone: 253-572-0571; email: dan@hylandmarine.com.

I look forward to working with you in coordinating access to the property during this important work. Please acknowledge receipt and acceptance of the terms in this letter by signing below and returning a copy to me.

If you have any questions, please call me.

Yours truly,

Kenneth E. Ruggles
Chief Financial Officer

Accepted on behalf of HHCG:

ATOFINA Chemicals, Inc.

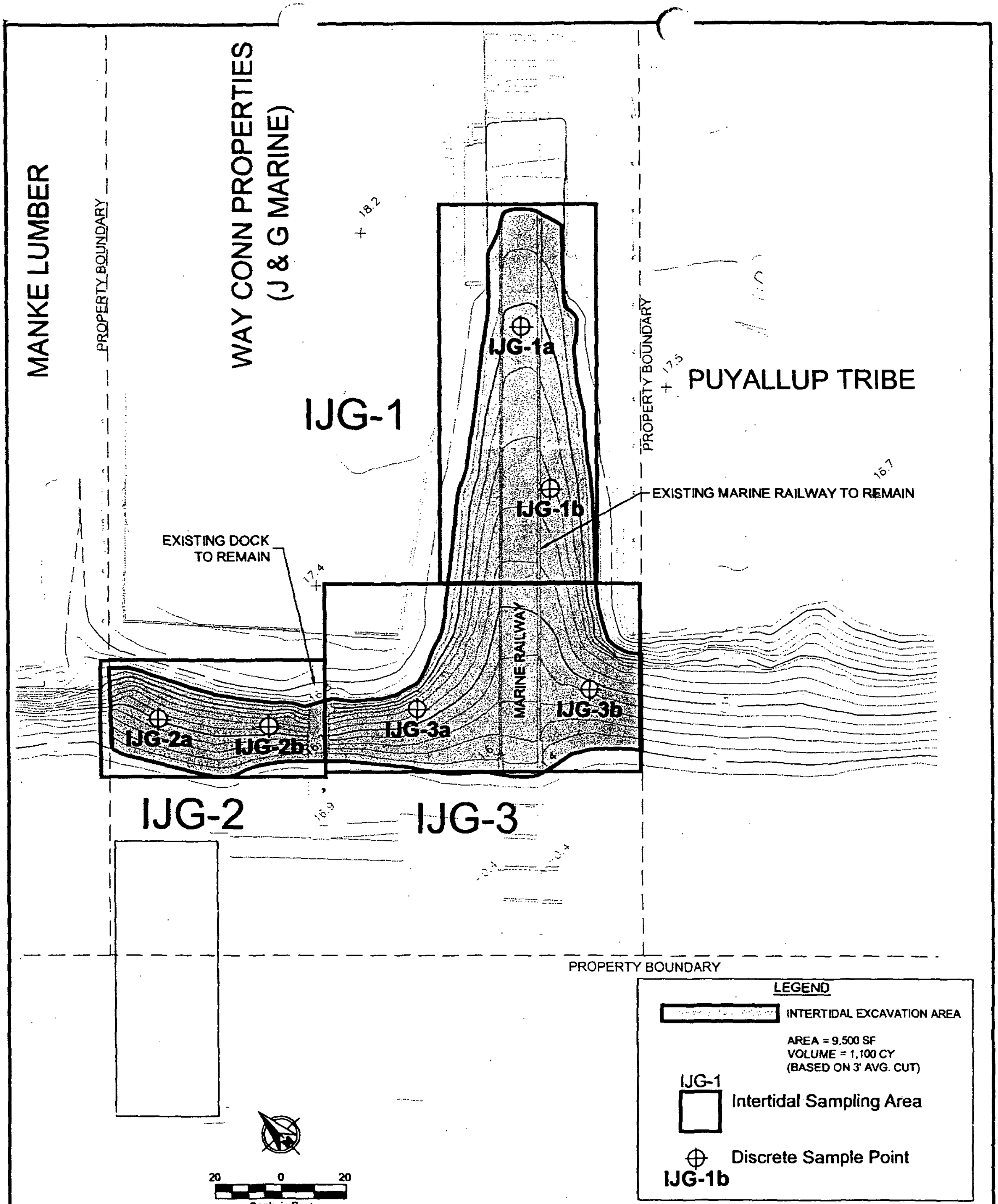
By: ______________________

Date: 02 April 03

General Metals of Tacoma

By: ______________________

Date: 02 APR 03



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2. CONTOURS PHOTOGRAMMETRICALLY MAPPED BY WALKER AND ASSOCIATES MAY 2002.
3. STRUCTURES DERIVED FROM PHOTOGRAMMETRICALLY MAPPED DATA.
4. PROPERTY LINE BOUNDARIES DERIVED FROM CITY OF TACOMA PUBLIC WORKS DEPT. GIS DATA. THIS DATA IS APPROXIMATE AND MAY NOT REFLECT ACTUAL RECORDED SURVEYS.

Figure S-4
Intertidal Sampling Areas
J&G Marine (Way Conn Prop.)
Head of Hylebos Waterway

Dalton, Olmsted & Fuglevand, Inc.	March 2003	Hylebos

F - WQMP

Appendix F
Water Quality Monitoring Plan

WATER QUALITY MONITORING PLAN

Head of Hylebos Waterway Problem Area:
Segments 1 and 2

Commencement Bay Nearshore / Tideflats Superfund Site
Tacoma, Washington

Prepared for:

Head of Hylebos Cleanup Group
- ATOFINA Chemical Corp
- General Metals

Revised: 9/29/02

Dalton, Olmsted & Fuglevand, Inc. *Environmental Consultants*

Silverdale, Washington
September 2002

INTRODUCTION

In-water remedial activities are planned for the Head of Hylebos Waterway Problem Area. This site is part of the Commencement Bay Nearshore / Tideflats Superfund Site in Tacoma Washington. This plan describes procedures for the monitoring of surface water quality during the implementation of remedial activities at the Head of Hylebos Waterway. The plan also includes methods for monitoring of water quality prior to the start of in-water work to determine existing background conditions. Procedures and criteria for reporting an exceedance of water quality standards during remedial activities are presented.

PROJECT DESCRIPTION

The project involves in-water work including remedial dredging, the removal of existing structures, potential moving and replacement of other existing structures and sand grading and capping.

Dredged material will be loaded onto barges, moved to the offload facility which will be constructed within the project boundaries at the ATOFINA property, offloaded from barge and placed into rail car containers. Material will then be transported by rail to Roosevelt Regional landfill for disposal.

To perform the necessary remedial dredging, some existing structures may be removed. Some of these structures may be re-constructed upon the completion of remedial activities.

Water quality monitoring will be conducted during the performance of the following remedial activities:

- Open Access Area Dredging
- Under Dock Area Dredging
- Sediment Offload
- Sand Capping or Grading of Remediated Areas

Open access dredging includes all remedial dredging performed in areas other than under docks at Hylebos Marina or Tacoma Boat. Open access dredging will be performed by clamshell or excavator bucket. Dredged sediments will be placed within haul barges for transfer to shore where the material will be offloaded to containers for rail shipment. Occaisionaly, the dredged sediments may be placed directly into containers staged on the barge and the full container transferred to shore.

Underdock dredging may be performed at the Tacoma Boat (SMA 131) and Hylebos Marina (SMA 233) portions of the project. These are areas of limited access potentially requiring different dredging techniques. Existing docks and boathouses at the Hylebos Marina may be relocated such that these areas become roughly equivalent to open access. Under dock dredging may be done using a combination of land and marine based equipment. Sediments will be dredged and placed into barge or directly into containers.

Dredged sediment which is loaded into barges must be transferred from the barge to the uplands for deposit within the containers for transport to the landfill. The sediment offload site will be at the ATOFINA Property, which is inside the project limits. This site has an existing dock and rail line. Dredged material will be transferred from the barge to the containers staged on railcar by pump, conveyor or other mechanical means. Alternately, dredged material may occasionally be stockpiled within the former salt ponds which exist onsite, and then transferred to containers.

The upland area where sediment transfer occurs will be paved with asphalt. Stormwater management will be provided in this area to capture storm runoff.

Water that accumulates in the haul barge during dredging and prior to offloading will be allowed to discharge back into the waterway as return water. The barge overflow water will pass through straw bales or similar filter media to reduce turbidity effects. Water that accumulates at upland holding facilities will be collected and held overnight while fines settle out and then will be discharged back into Hylebos Waterway as return water of the dredging program[1].

PROJECT SPECIFIC WATER QUALITY CRITERIA

Previously performed dredge elutriate tests have indicated no chemical exceedances of water quality are expected due to remedial actions. However, short term impacts on turbidity and DO may occur as a result of the remedial action. Water quality monitoring performed during the December 2002 Pilot Program indicate effects on turbidity and DO should be minimal. To prevent degradation to water quality as a result of the remedial action, in-situ monitoring and Best Management Practices (BMP's) will be used.

Dissolved Oxygen

The following project specific Dissolved Oxygen criteria will be applied during all in water remedial actions.

- In water remedial actions (Dredging, structure removal, capping and sediment transfer) can proceed provided DO measurements at all compliance monitoring stations are above 3.0 mg/l.

[1] Turbidity measurements from the Hylebos column settling tests were generally less than 10 NTU after 12-24 hours of settling. Section 3.3.3.3 of Round 1 Data Report. March 20, 1998. Striplin Environmental Associates.

- In water remedial actions will cease if DO drops below 3.0 mg/l at any compliance monitoring station

- In water remedial actions will resume when DO is greater than 3.0 mg/l for a 6 hour period.

Turbidity

Planned remedial actions are expected to create short periods of increased turbidity. To reduce turbidity increases due to dredging, best management practices will be used during the remedial action.

The BMP's intended to reduce the impact of the remedial actions on turbidity include:

- Use of properly sized equipment for all operations
- Relatively slow bucket speeds in water
- Bucket will be placed (stopped) at the designated depth of digging to prevent overfilling the bucket
- No sweeping of the bottom with the bucket will be allowed
- No stockpiling of material will be allowed (Each bucket closure will be brought to surface and placed in barge)
- During retrieval bucket will pause at water surface to release excess water and minimize sediment loss
- Haul barges will not be overfilled allowing material to flow directly back into the waterway
- All return water will be filtered through hay bales or other appropriate media prior to return to waterway

MONITORING EQUIPMENT DEPLOYMENT

A combination of fixed, semi-fixed and mobile casting equipment will be deployed to perform water quality monitoring during the project. All instruments will be equipped to measure DO, turbidity and temperature.

New, state of the art equipment manufactured by YSI is planned for the project. The fixed stations will each include three YSI 6600 Extended deployment system multi-parameter water quality loggers. These instruments utilize a patented wiping technology to maintain the sensors free from biological fouling. For robustness and cross compatibility, additional 6600 units will be used for the semi fixed stations and the casting instrument.

The four fixed and two semi fixed stations will use YSI 6200 data acquisition systems to record and manage data at the station prior to transmitting to central station onsite.

Fixed Equipment

A series of four fixed instrument arrays will be deployed at the site for continuous real time water quality monitoring. The locations of the four fixed arrays are shown on Figure 1. Each of the four arrays will consist of sensors mounted at three fixed depths; approximately 1 meter above bottom, mid depth and near surface, based on expected MLLW conditions. At each depth DO, turbidity and temperature data will be recorded at 30 minute intervals. Each array will be deployed from a piling or similar structure. Data collected by the arrays will be transmitted to a central data processing station on-shore at the ATOFINA property.

Semi-Fixed Equipment

During dredging, an instrument to measure DO, turbidity and temperature will be deployed from the dredge barge at the non digging end. Depending upon barge size, this will be approximately 80' to 125' from the point of dredging. This instrument will also transmit data recorded at 30 minute intervals to the onshore data processing station.

Mobile Cast Equipment

A casting instrument will be deployed from the sampling vessel as needed to supplement and verify data from the fixed instrument arrays. Casts performed from the survey vessel will be used to examine spatial and temporal variations between fixed sensor arrays, location of cast and point of dredging. All casts will include measurements at near mudline, mid depth and near surface.

DETERMINATION OF BACKGROUND CONDITIONS

Determination of background conditions will be performed using a combination of the fixed equipment and cast equipment. The fixed monitoring equipment will be installed at the site prior to the start of the remedial in-water work. In addition, monitoring at one or more reference stations within Hylebos Waterway and Commencement Bay will be performed using a cast instrument deployed from the sampling vessel. Near-field reference stations will be located approximately 600' from the project boundary. Figure 1 shows the limits of the project, the four proposed compliance monitoring stations and the near-field reference monitoring stations.

Background conditions will be monitored at the fixed stations for approximately 6 to 8 months prior to the start of in-water work. During that time, the fixed sensors will record data on ½ hour intervals and telemetry the data to shore. The recorded data will be evaluated to determine statistical evaluation points including average, median, maximum and standard deviation of recorded data. The statistical data developed will then be used to evaluate potential effects of the in-water work on DO and turbidity.

WATER QUALITY MONITORING DURING IN-WATER WORK

Intensive Water Quality monitoring will be performed during all in-water work using the fixed equipment, semi-fixed equipment and mobile casting equipment.

Monitoring will be performed 24 hours per day, 7 days per week using the fixed and semi fixed equipment. This system will record data from all sensors at 30 minute intervals for the duration of the project. This will provide real time data from each equipment location, which can be used to monitor water quality during project activities. By performing continuous real time monitoring, changes in water quality can be detected as they occur and resolution achieved faster than with conventional monitoring performed by casting instruments once per day.

To determine spatial and temporal variations of any potential impacts to water quality caused by the remedial action, additional monitoring using the cast instrument will be performed during the first week of dredging and 1st week of operation with the second dredge. During these times, additional casts will be made at distances of 150' and 300' from the point of dredging. The cast equipment will be available for the duration of the in-water work, as needed for supplemental data collection.

Water Quality Parameters

All previously performed dredging elutriate tests from the Head of Hylebos Waterway showed no exceedance of applicable marine water quality criteria[2]. Therefore water quality management and associated monitoring will focus on turbidity and DO levels during dredging, sand grading and dredged sediment offloading.

Monitoring Locations

Fixed Stations

As previously discussed, four fixed arrays will be deployed roughly equidistant apart within the project area. The Four fixed stations will be deployed as listed in Table 1 and are shown on Figure 1.

Semi-Fixed Stations

A monitoring station will be located on each dredge barge, at the non-digging end of the barge. These continuous monitoring stations will move with the dredge and record data at a fixed distance from the point of dredging, within the mixing zone. The sensor depth will be adjustable to near bottom, mid depth or near surface deployment.

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[2] Dredging Elutriate Test, Head of Hylebos Waterway. March 9, 2001. Dalton, Olmsted & Fuglevand, Inc.

TABLE 1 Fixed Stations

Array #	Station #	Side of Waterway	Location Description	Sensor Types
1	~112+25	South	Atofina Diffuser Pier	DO, Turbidity & Temperature at 3 depths
2	~122+00	South	Atofina Dock	DO, Turbidity & Temperature at 3 depths
3	~133+50	North	General Metals Dock	DO, Turbidity & Temperature at 3 depths
4	~147+00	North	Ace Tank Dock	DO, Turbidity & Temperature at 3 depths

Mobile (cast) stations

During the first week of dredging, the first week of dredging with two dredges simultaneously and other periods as determined necessary based on field conditions, additional monitoring will be performed with the cast instrument. Monitoring stations for cast equipment will be determined by distance from the point of dredging. Using onboard DGPS, point of dredging and point of sampling will be recorded. Monitoring will occur at distances of approximately 150' and 300' from point of dredging. Stations will be selected in the field which are appropriate for given tidal and other conditions. Monitoring will be performed between the point of dredging and nearest fixed station to evaluate spatial and temporal variations, if possible.

Compliance Monitoring During In-Water Work

During in water work, compliance monitoring will be performed using the fixed arrays, semi fixed array and the cast equipment as previously described. The fixed and semi fixed instruments will provide approximately 670 data readings per day for each parameter (DO, Turbidity and Temperature), providing a comprehensive, real time report of water quality within the project area.

Reference Station Monitoring During In Water Work

Two near-field reference monitoring stations will be established within the waterway north and south of the project, at a distance where project effects on water quality are not expected. Monitoring will be performed at the reference stations during the first week of dredging and at other times during the project as deemed necessary by field conditions. If WQ exceedances are determined by the fixed stations at either end of the project, additional monitoring at the reference station will be performed to evaluate off site effects on WQ within the project area.

Water Column Monitoring Depths
At all stations, monitoring will typically be performed at 1 meters above the mudline, mid depth and near surface, based on mean lower low water (MLLW).

Monitoring Frequency
Due to the duration and variable nature of the project, monitoring will be performed on a continuous basis, at the four fixed and two semi fixed monitoring stations. Monitoring results will be internally stored within the instrument and transmitted to the onsite data storage system via the telemetry system.

Monitoring at the reference station will be performed a daily basis during the first week of dredging and as deemed necessary based upon field conditions.

TSS Sampling
In addition to in situ monitoring for DO, Turbidity and temperature, TSS samples will also be collected at various stages of the project for comparison with in situ turbidity readings. TSS samples will be collected from 1 meter above the bottom, mid depth and near surface to coincide with insitu monitoring depths. TSS samples will be collected once per day during the first week of dredging at a distance of approximately 150' from the point of dredging. TSS samples will then be collected once per week at a distance of approximately 150' from the point of dredging.

Sample Location Documentation.
The location of all installed sensors will be determined in the field by DGPS, distance and offset or other standard surveying techniques.

Location of any additional in-situ monitoring or sample collection will be recorded by DGPS at time of monitoring or sampling.

EQUIPMENT CALIBRATION

All monitoring equipment will be calibrated, handled and operated per manufacturer's recommendations. Calibration information will be recorded in the field notebooks or calibration logs.

For fixed installations, instruments will be calibrated prior to deployment and then on an as needed basis, based on instrument performance and manufacturers instructions.

For instruments used for monitoring from boat or other location (cast instruments); calibration will be performed as required by the manufacturer.

Equipment necessary to perform Winkler Titrations will be set up onsite for DO equipment calibration and verification.

MONITORING DOCUMENTATION

Water Quality data will be logged internally by the instruments and telemetried to a shore station for recording. The telemetried data will be saved by the on-site data logging system. Plots indicating daily trends in turbidity and DO will be generated for rapid data analysis.

For additional in-situ measurements performed by casting instrument from boat, monitoring data will be stored internally by the unit for electronic transfer to computer. Data may also recorded in the field book or on field data forms. Position data will be recorded from the GPS on the vessel for each monitoring cast performed.

QUALITY CONTROL AND ASSURANCE PROCEDURES

Field equipment will be calibrated using methods and frequencies specified by the equipment manufacturer. Fixed monitoring locations will be determined by DGPS at time of sensor installation and recovery. For individual casts, location will be determined by DGPS at time of monitoring.

NOTIFICATION OF WATER QUALITY (TURBIDITY AND DISSOLVED OXYGEN) EXCEEDANCES

In the event of a water quality (turbidity or DO) reading exceeding the standard (elevated turbidity or depressed DO); the following steps will be implemented. Due to the transient nature of the process being monitored and instrument operational characteristics, the elevated readings must be persistent for a minimum of 60 minutes to be considered an exceedance of water quality.

Monitoring data from the sensors fixed and semi-fixed equipment will be telemetried to the onsite project management office. Data will then be compared with exceedance criteria established based upon results of background monitoring performed prior to start of in-water work and listed within project Water Quality Certification to be issued by EPA.

If an elevated turbidity or depressed DO condition is detected, no action will be taken until the next monitoring cycle is completed. (Sensors will record and transmit data at 30 minute intervals). If at the next monitoring cycle (30 minutes after initial elevated turbidity or depressed DO is detected) the exceedance persists, a visual assessment will be made of the station vicinity for potential outside (Non project) influences which could be impacting monitoring results. If DO has dropped below 3.0 mg/l at any compliance monitoring station for two consecutive readings, all in-water remedial action will cease and EPA be notified immediately by the onsite project manager and / or a combination of automatic e-mail or pager notification by the central data station computer.

If the exceedance does not persist during the second monitoring cycle, a third monitoring cycle would be monitored to verify that the condition does not persist and to confirm the pass.

If after the second monitoring cycle station turbidity continues to exceed the standard, and the visual assessment of the area indicates no outside influences, measurements will be taken at the reference station to verify current background conditions and the on-site Project Manager will be notified. At this time, EPA and other agencies will be notified of the turbidity exceedance by the onsite project manager and / or a combination of automatic e-mail or pager notification by the central data station computer.

Proposed resolution will be based upon observed field conditions and the perceived cause of exceedance. Potential modifications may include installation of addition filtration media for return water sources or changes to dredge operation or equipment.

Additional monitoring may be performed from the sampling vessel or docks etc. as needed to confirm the extent and potential causes of the exceedance. Other stations, including the reference station, may also be sampled to provide comparative values.

If the exceedance persists during a third monitoring cycle and no outside (non-project) causes can be determined, the on-site project manager will implement the proposed resolution. Monitoring will then continue through the next monitoring cycle to verify the effect of the proposed resolution. The exceedance and resolution will be documented and reported to EPA.

If the exceedance continues after initial procedure modification, additional modification of the in-water work may be proposed as needed to alleviate the condition. Additional monitoring and procedure modification will continue until the exceedance is resolved.

REPORTING

Weekly Progress Reports

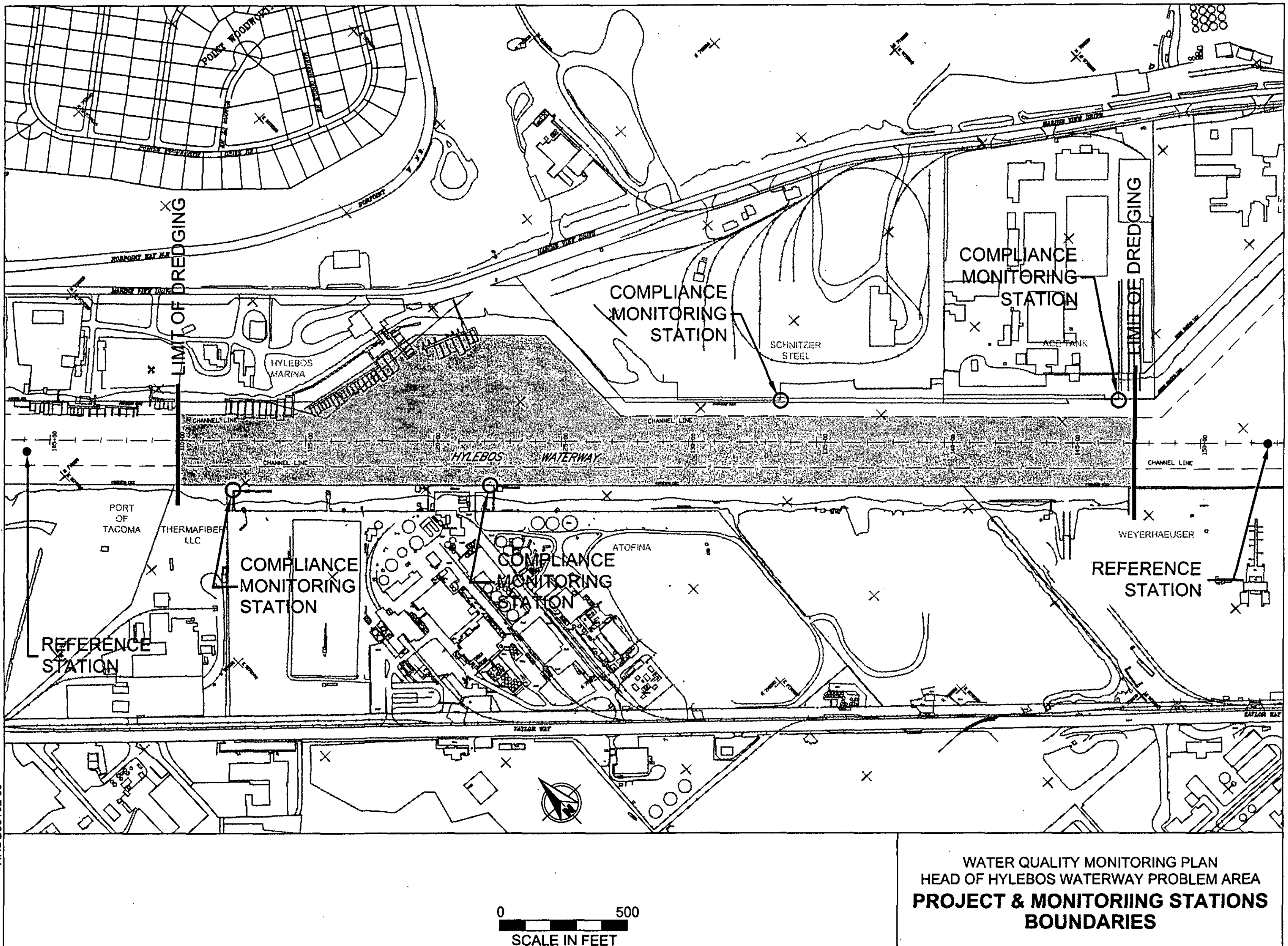
During active in-water remediation, an electronic (email) report will be issued each week to EPA to summarize the measured exceedances (if any) of project water quality criteria during the prior week.

Data Report

At the completion of the project, a summary report will be prepared describing water quality monitoring field activities and results of all water quality monitoring. The data report will be submitted to EPA as part of the RA Construction Report.

REFERENCES

YSI Environmental Products – WWW.YSI.com



HHCG00102-09

WATER QUALITY MONITORING PLAN
HEAD OF HYLEBOS WATERWAY PROBLEM AREA

PROJECT & MONITORIING STATIONS BOUNDARIES

0100202 **FIGURE 1** 10/01/02

Dalton, Olmsted & Fuglevand, Inc.

G - 2003 Cost

Appendix G
2003 Cost Estimate

Head of Hylebos Waterway
2003 Remedial Action

Engineers Cost Estimate
Prepared By Dalton, Olmsted & Fuglevand, Inc.

Land Based Work

Description of Item	Approximate Quantity	Unit	Unit Price	Total Price
Mobilization				
Mobilization	1	Lump Sum	$ 15,000	$ 15,000
ATOFINA Salt Pad Cleanup and Preparation	1	Lump Sum	$ 50,000	$ 50,000
Mobilization Sub Total				**$ 65,000**
Earthwork				
Intertidal SMA Remediation Excavation	7,400	CY	$ 20.00	$ 148,000
Bank Cleanup Excavation	33,900	CY	$ 13.00	$ 440,700
Screening and Stockpiling	27,000	CY	$ 2.00	$ 54,000
Earth Work Sub Total				**$ 642,700**
Materials Placement				
Transition Zone Grading	18,750	Ton	$ 20.00	$ 375,000
Quarry Spalls	1,800	Ton	$ 22.00	$ 39,600
Boulders	53	Each	$ 1,000	$ 53,000
Large Woody Debris	7	Each	$ 2,500	$ 17,500
Materials Placement Sub Total				**$ 485,100**
Demolition				
ATOFINA Diffuser Pier Land Connection Demolition	1	Lump Sum	$ 5,000	$ 5,000
ATOFINA Salt Pier Pier Land Connection Demolition	1	Lump Sum	$ 4,000	$ 4,000
ATOFINA Timber Bulkhead Demolition	1	Lump Sum	$ 35,000	$ 35,000
Atofina Concrete Structure Demolition	1	Lump Sum	$ 20,000	$ 20,000
ATOFINA Fence Removal	1	Lump Sum	$ 6,000	$ 6,000
Demolition Sub Total				**$ 70,000**
Landfill Disposal Costs				
Intertidal SMA Disposal	9,620	Ton	$ 26.25	$ 252,525
Bank Cleanup Debris Disposal	8,970	Ton	$ 26.25	$ 235,463
ATOFINA Structure Demolition Debris Disposal	500	Ton	$ 26.25	$ 13,125
Disposal Sub Total				**$ 501,113**
LAND BASED SUBTOTAL				**$ 1,763,913**

Marine Based Work

Description of Item	Approximate Quantity	Unit	Unit Price	Total Price
Mobilization	1	Lump Sum	$ 10,000	$ 10,000
ATOFINA Diffuser Pier Demolition	1	Lump Sum	$ 20,000	$ 20,000
ATOFINA Salt Pier Pier Demolition	1	Lump Sum	$ 30,000	$ 30,000
Guide Pile Installation				
15 piles at Hylebos Marina	15	Each	$ 2,000	$ 30,000
MARINE SUBTOTAL				**$ 90,000**
Cost Subtotal				**$ 1,853,913**
Engineering and Design			15%	$ 278,086.88
Construction Oversight and Surveying				$ 350,000.00
Contingency			15%	$ 278,086.88
2003 RA TOTAL ESTIMATED CONSTRUCTION COST				**$ 2,760,086**

H - 2003 Shoreline

Appendix H
2003 Shoreline Work Contractor Submittals

(Submitted under separate cover)

I - 2003 Marine

Appendix I
2003 Marine Work Contractor Submittals

(Submitted under separate cover)